FIG. 1

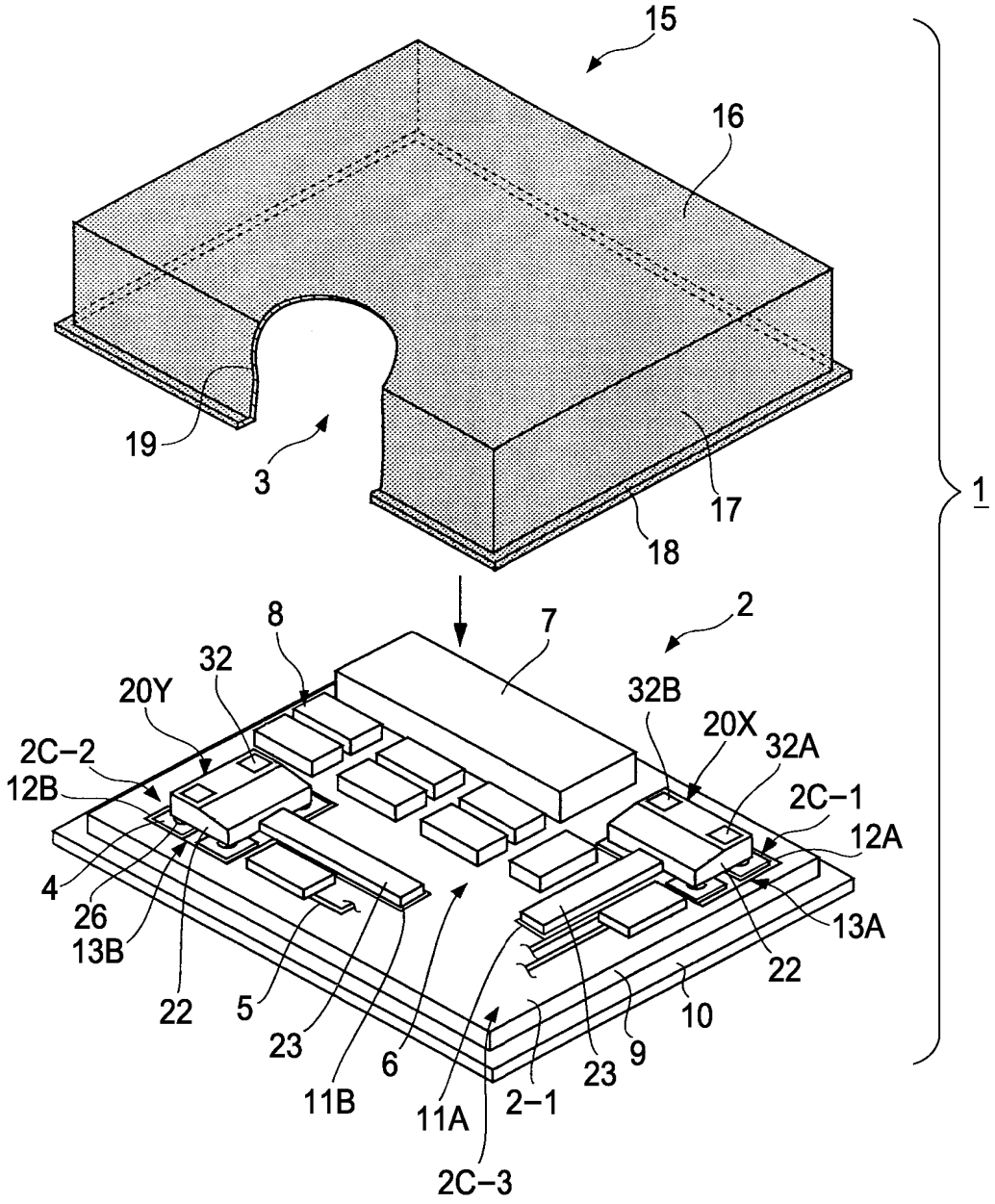
15
16
19
3
17
18
1
8
7
2
32
20Y
32B
20X
32A
2C−2
12B
2C−1
12A
4
26
13B
13A
22
5
22
23
10
6
9
23
11B
11A
2−1
2C−3

FIG. 2

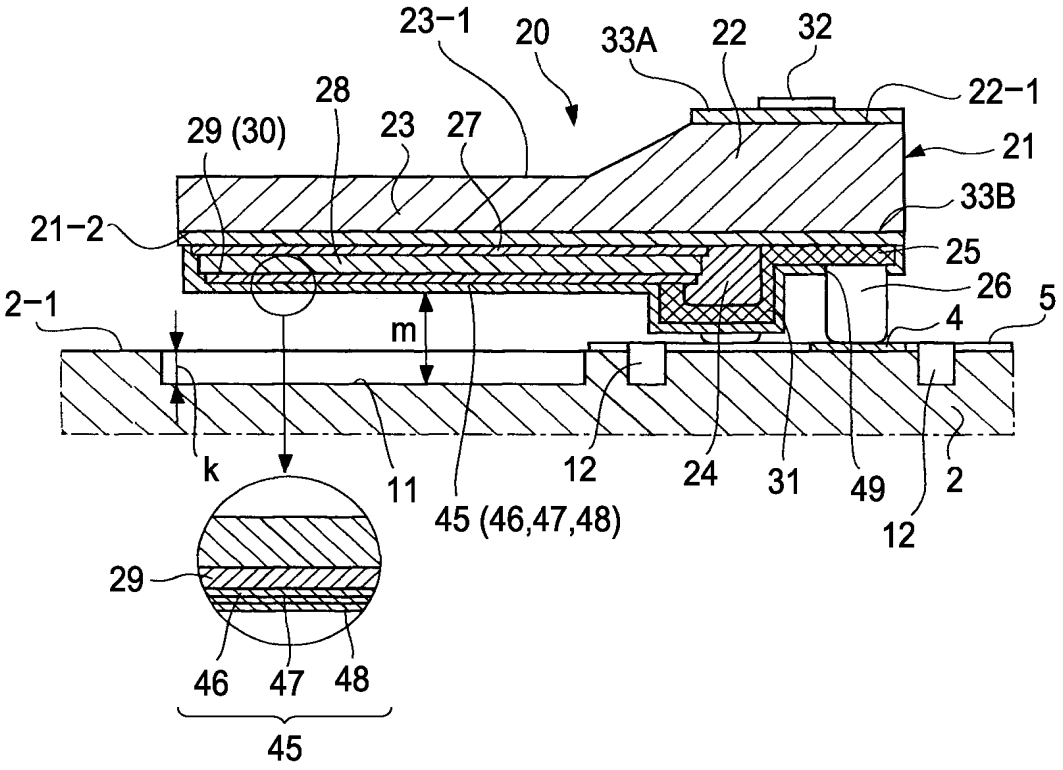
23-1
20
33A
22
32
22-1
28
29 (30)
23
27
21
33B
21-2
25
26
5
2-1
m
4
k
11
45 (46,47,48)
12
24
31
49
2
12
29
46
47
48
45

FIG. 3

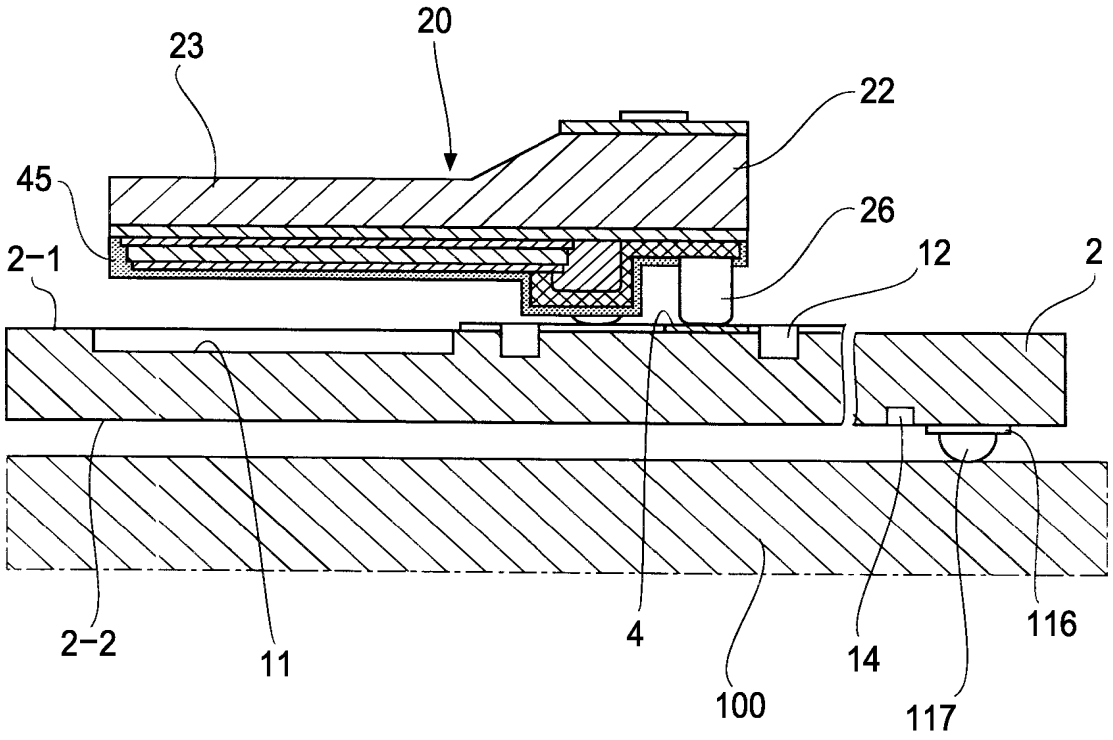

FIG. 4

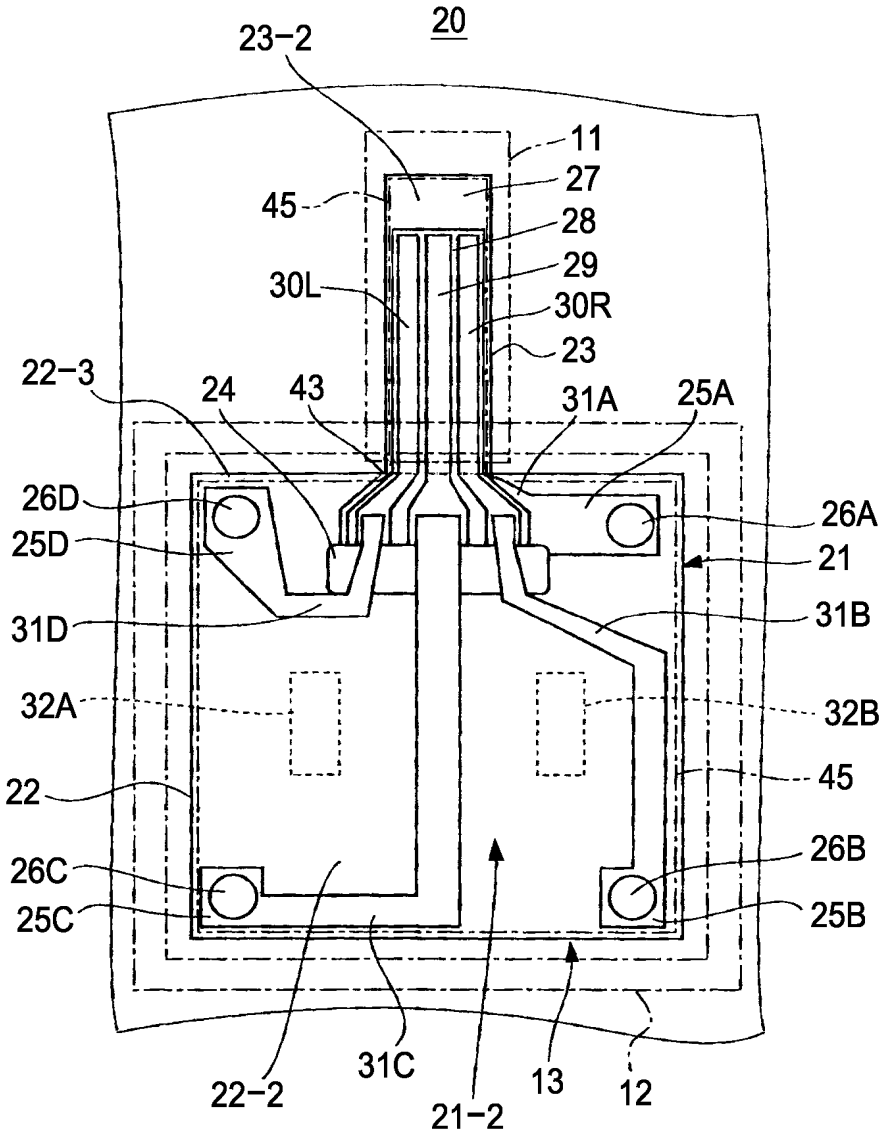
20
23-2
11
27
45
28
29
30L
30R
23
22-3
24
43
31A
25A
26D
26A
25D
21
31D
31B
32A
32B
22
45
26C
26B
25C
25B
22-2
31C
21-2
13
12

FIG. 5

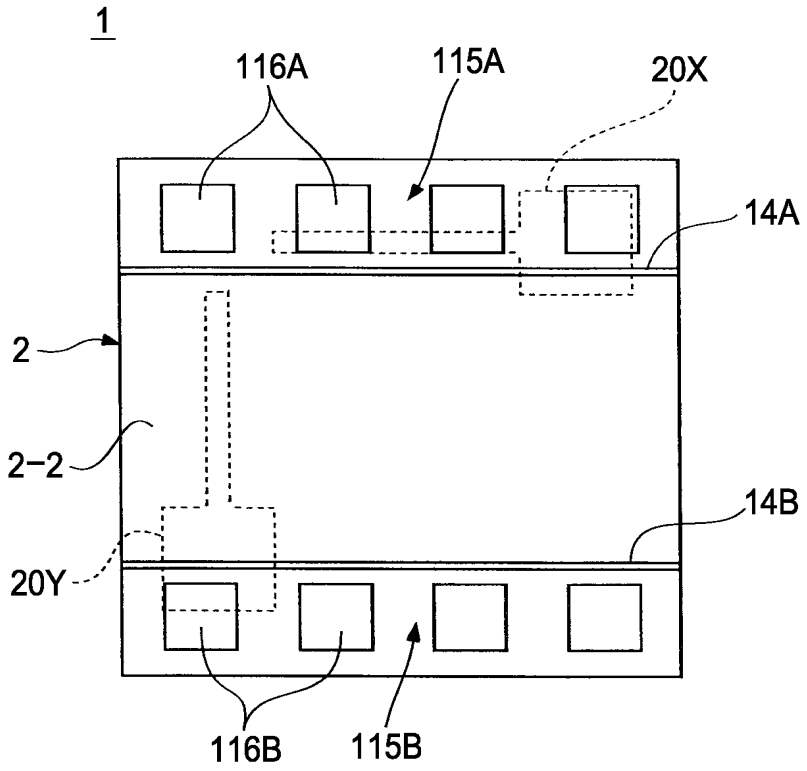

FIG. 6

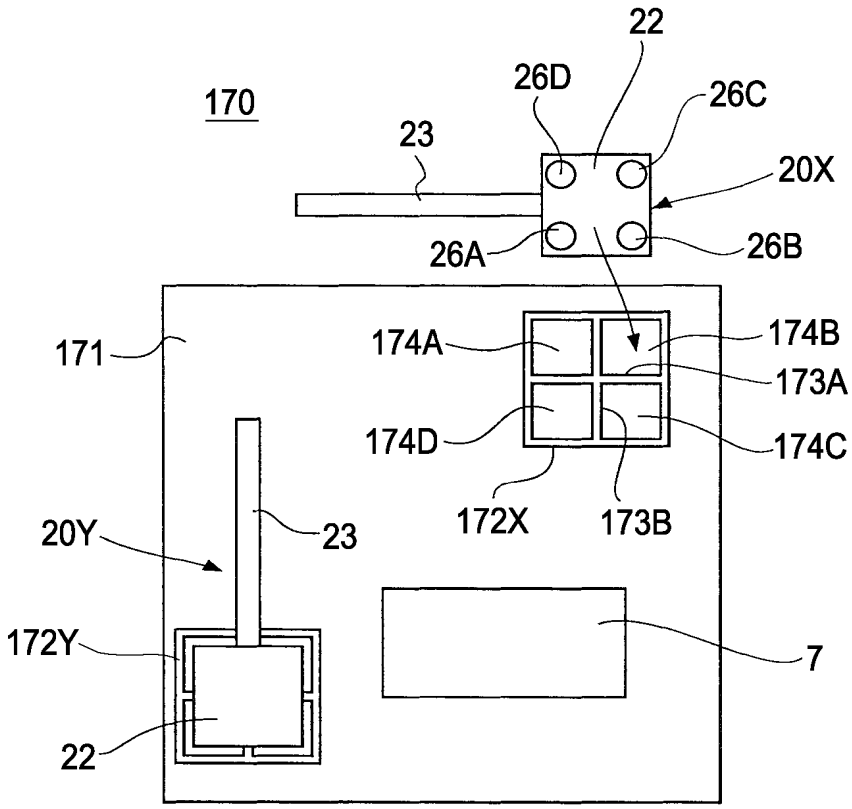
22
26D
26C
170
23
20X
26A
26B
171
174A
174B
173A
174D
174C
172X
173B
20Y
23
172Y
7
22

FIG. 7

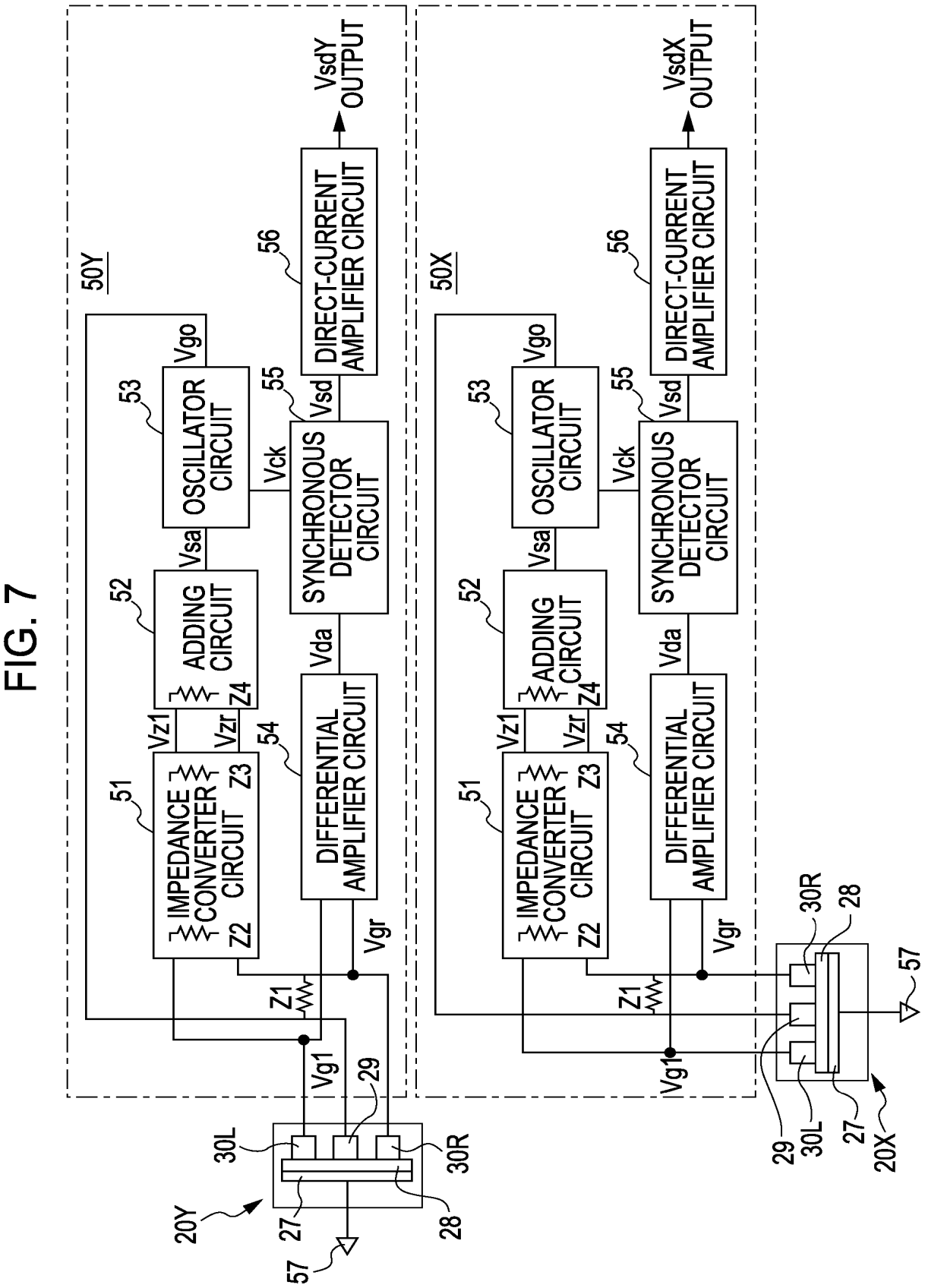
50Y
50X
51
52
53
54
55
56
IMPEDANCE CONVERTER CIRCUIT
ADDING CIRCUIT
OSCILLATOR CIRCUIT
DIFFERENTIAL AMPLIFIER CIRCUIT
SYNCHRONOUS DETECTOR CIRCUIT
DIRECT-CURRENT AMPLIFIER CIRCUIT
Z1
Z2
Z3
Z4
Vz1
Vzr
Vsa
Vgo
Vck
Vda
Vsd
Vgr
Vg1
VsdY OUTPUT
VsdX OUTPUT
20Y
20X
27
28
29
30L
30R
57

FIG. 8

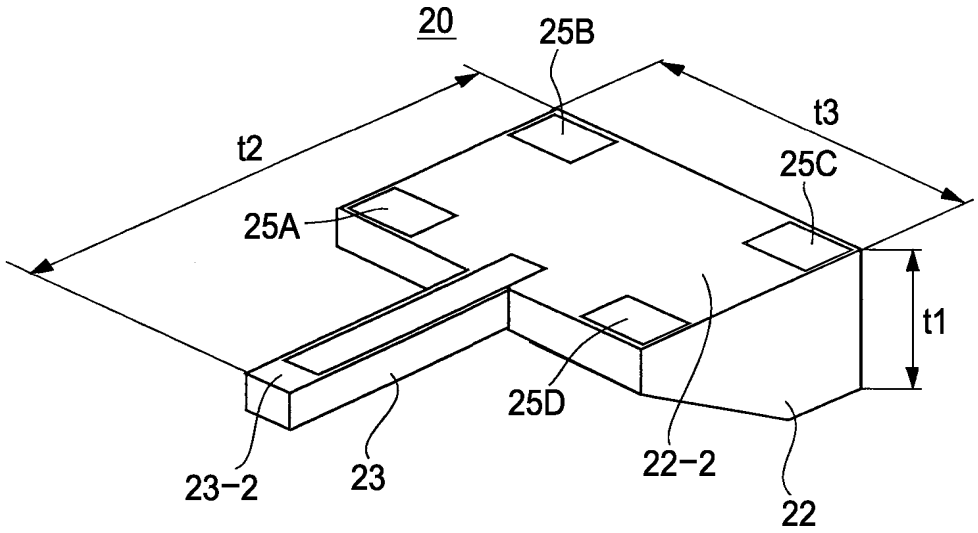

FIG. 9

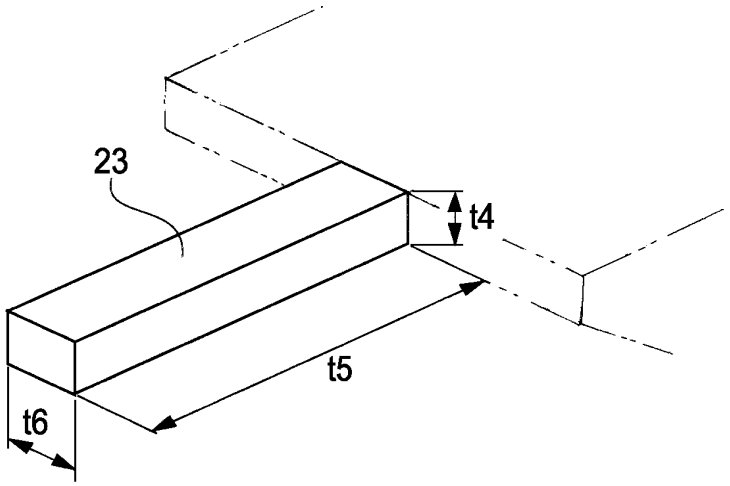

FIG. 10

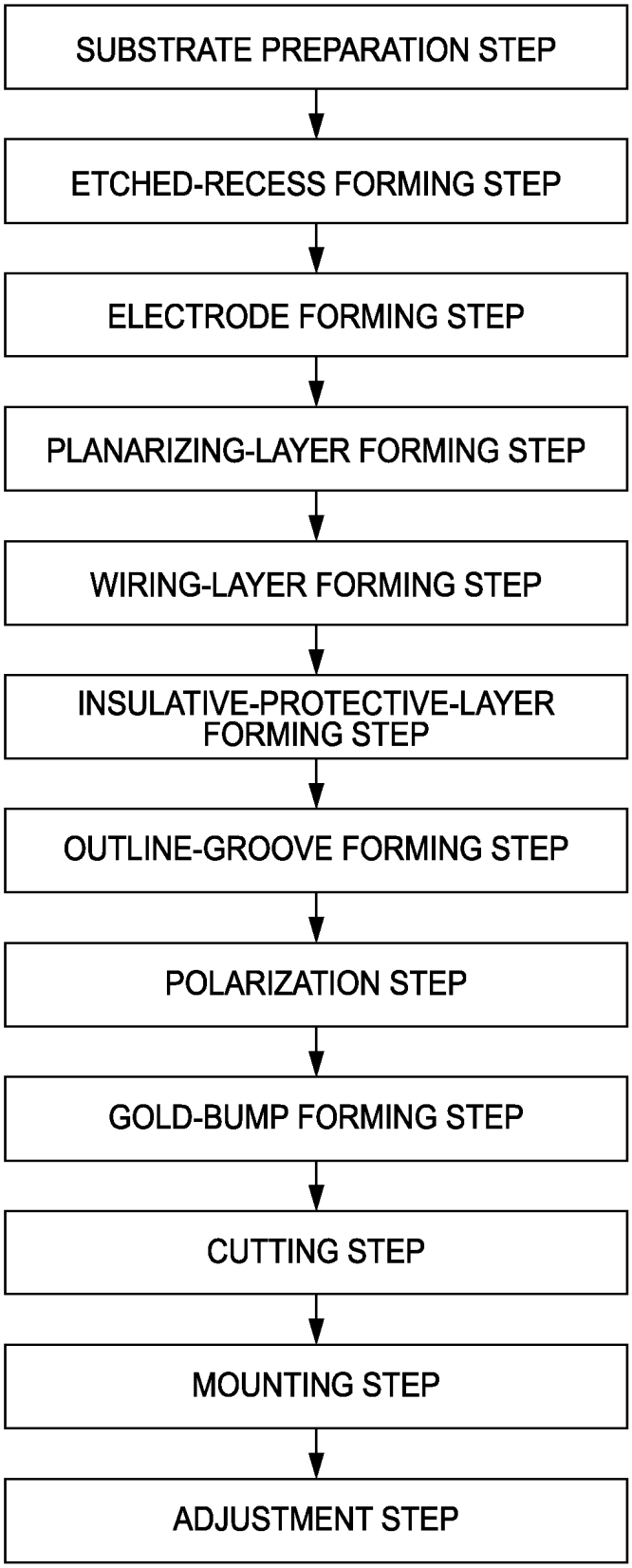
SUBSTRATE PREPARATION STEP
ETCHED-RECESS FORMING STEP
ELECTRODE FORMING STEP
PLANARIZING-LAYER FORMING STEP
WIRING-LAYER FORMING STEP
INSULATIVE-PROTECTIVE-LAYER FORMING STEP
OUTLINE-GROOVE FORMING STEP
POLARIZATION STEP
GOLD-BUMP FORMING STEP
CUTTING STEP
MOUNTING STEP
ADJUSTMENT STEP

FIG. 11

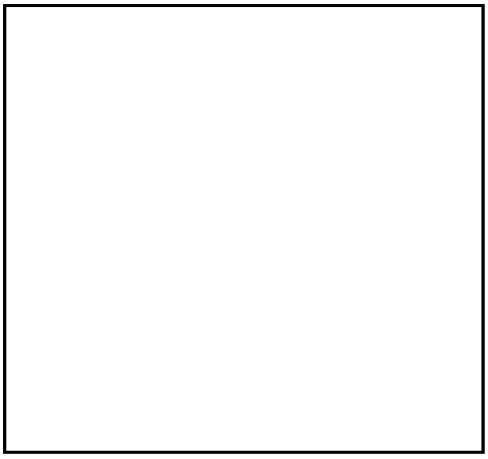

FIG. 12

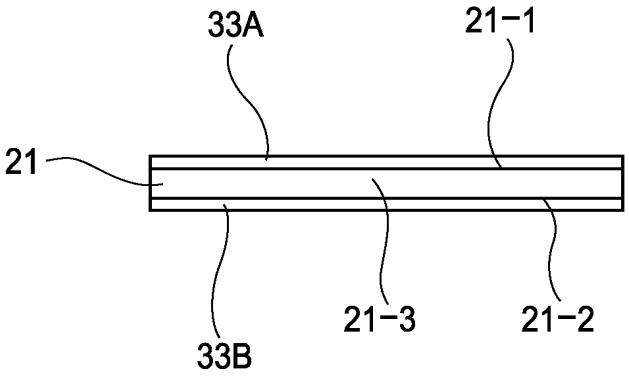

FIG. 13

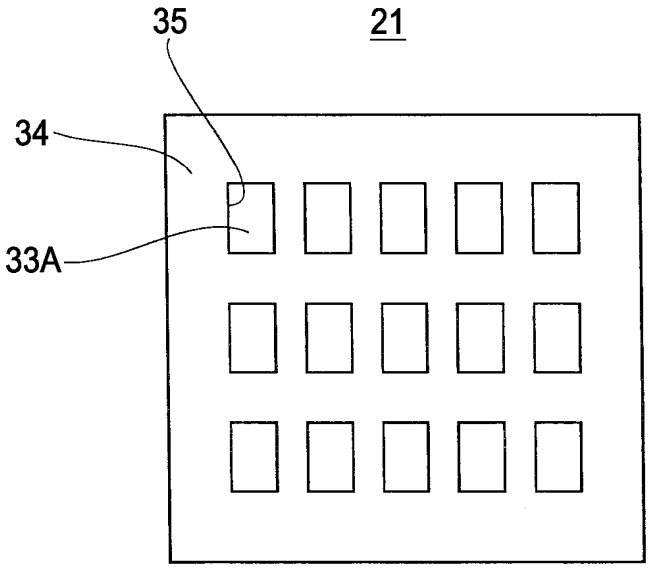

FIG. 14

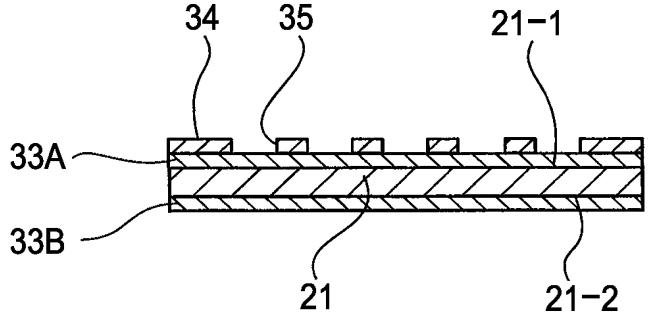

FIG. 15

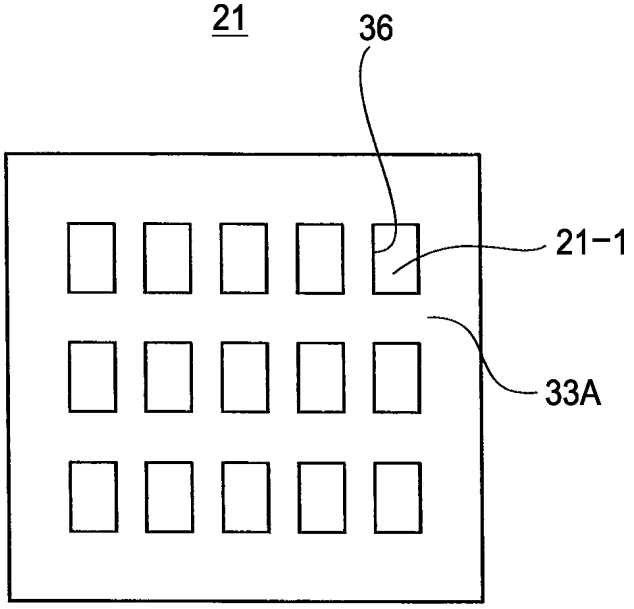

FIG. 16

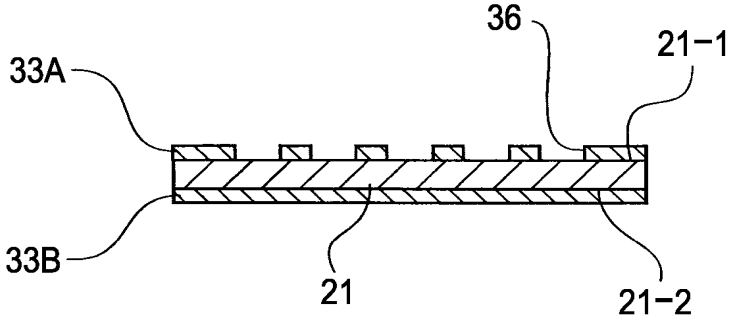

FIG. 17

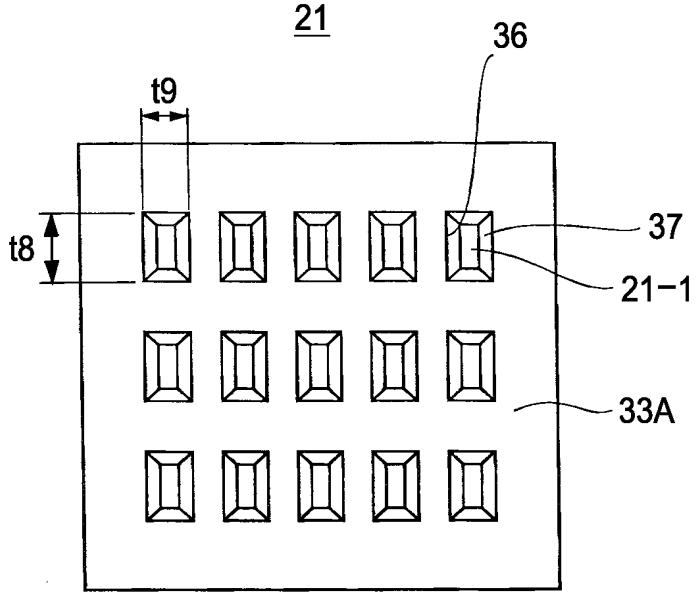

FIG. 18

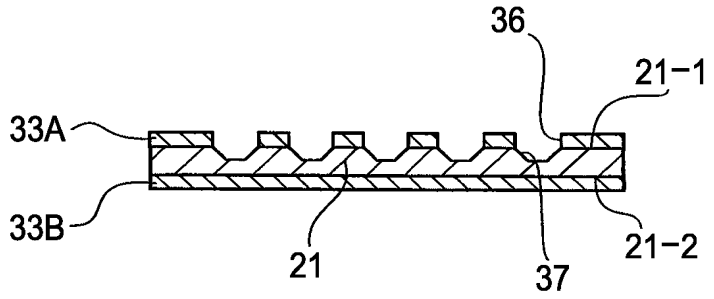

FIG. 19

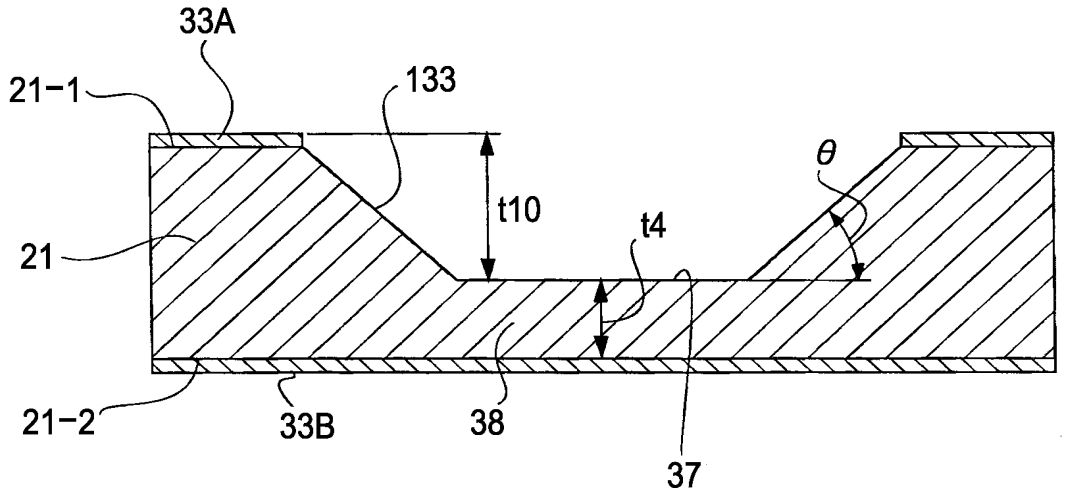

FIG. 20

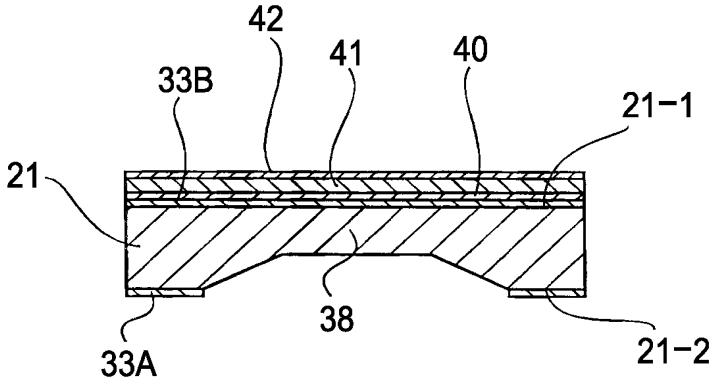

FIG. 21

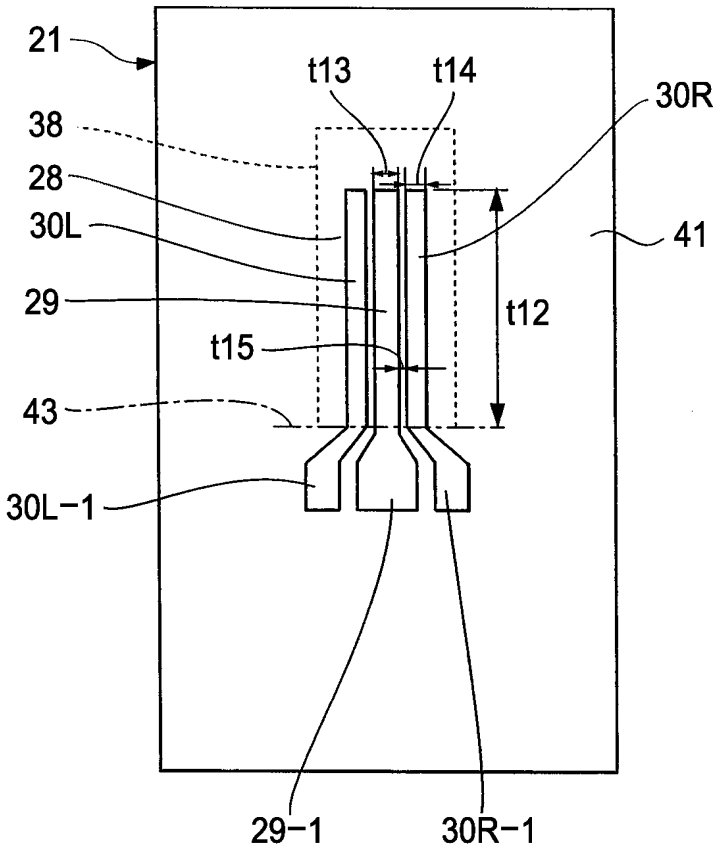

FIG. 22

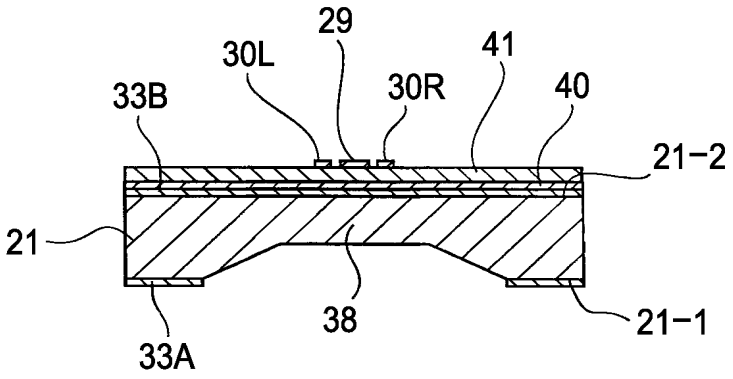

FIG. 23

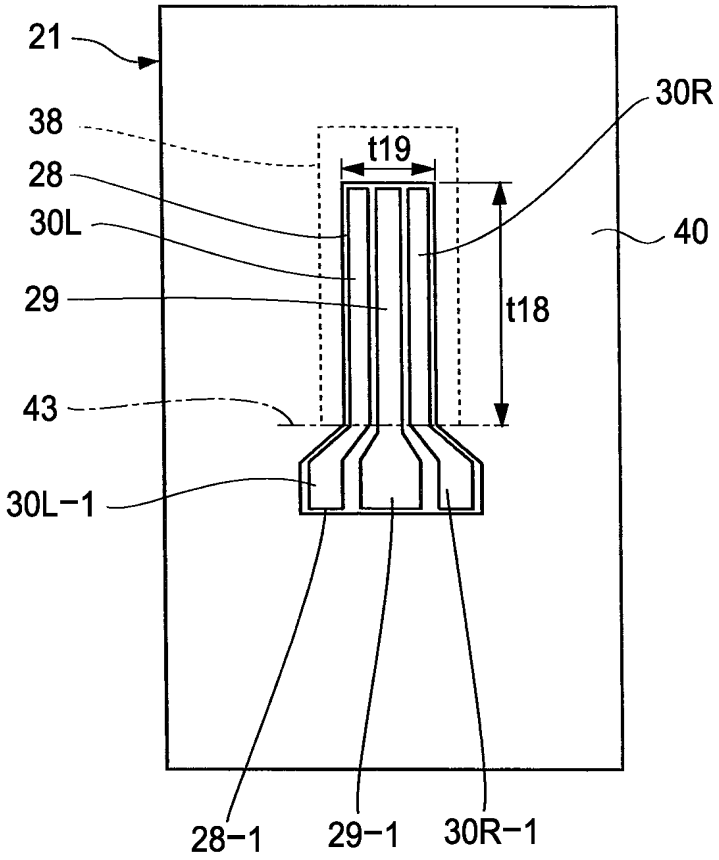

FIG. 24

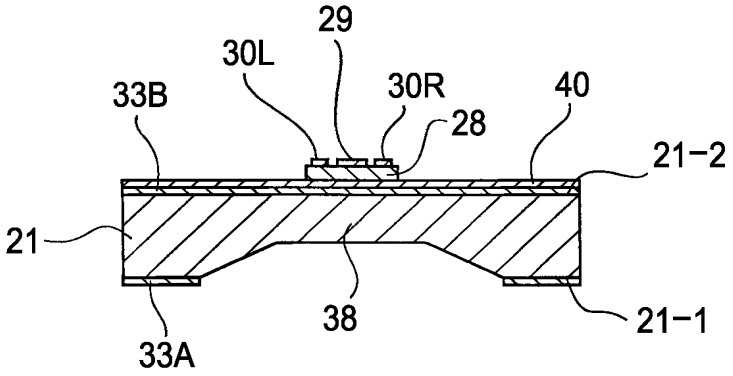

FIG. 25

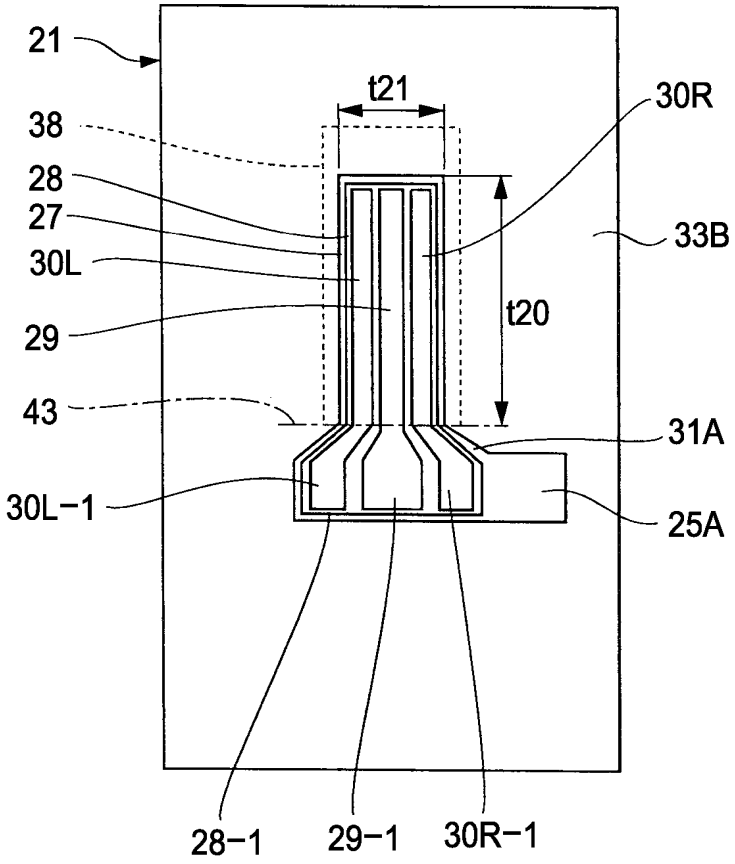

FIG. 26

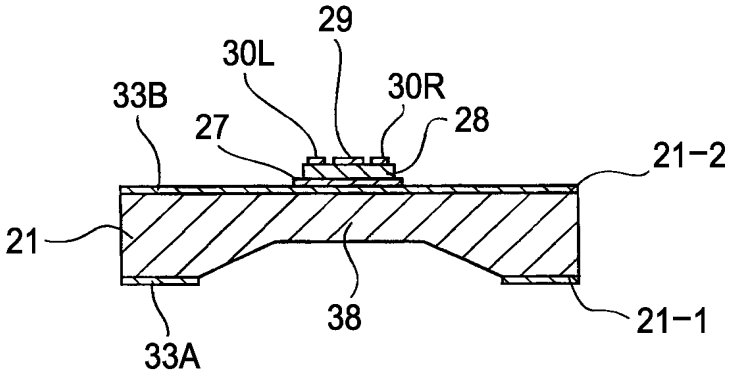

FIG. 27

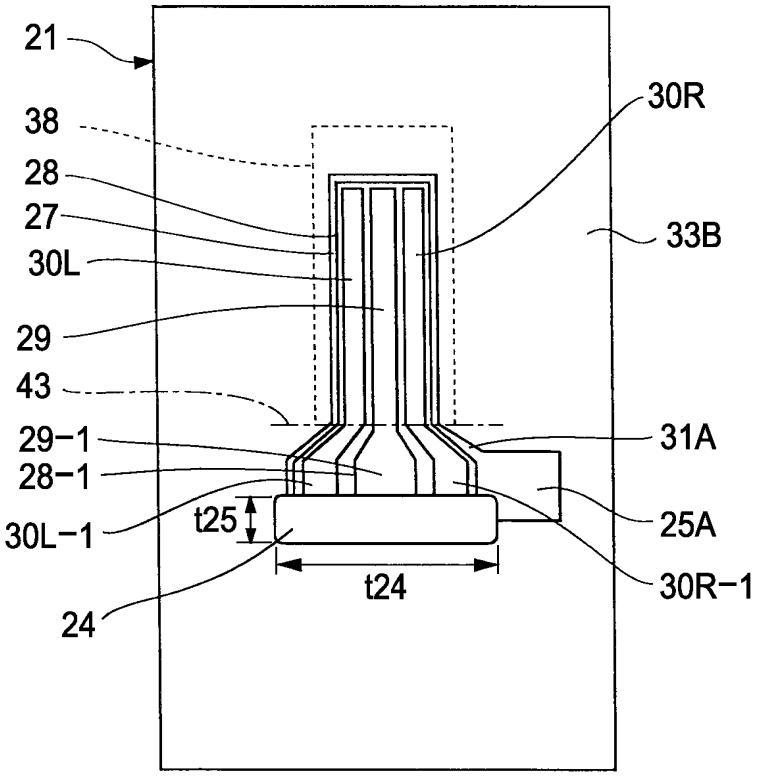

FIG. 28

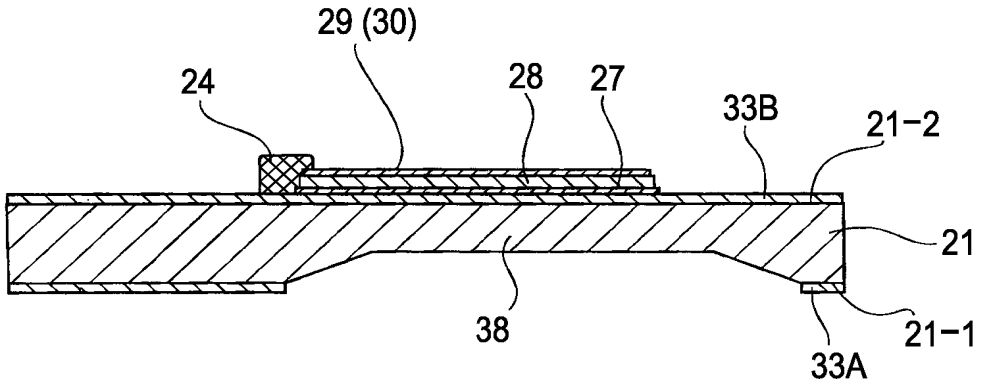

FIG. 29

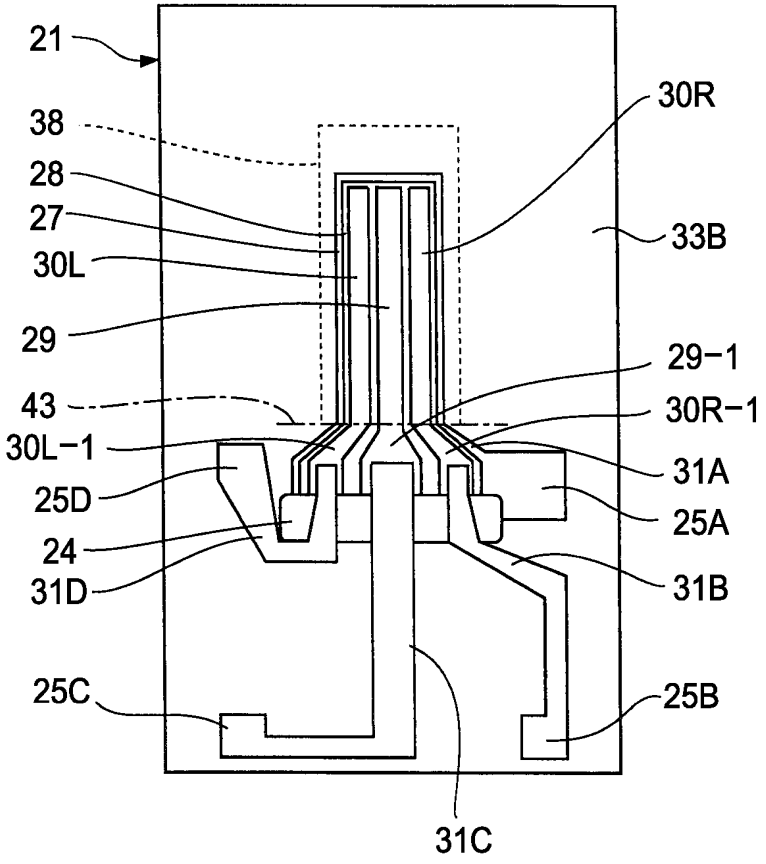
21
38
28
27
30L
29
43
30L-1
25D
24
31D
25C
30R
33B
29-1
30R-1
31A
25A
31B
25B
31C

FIG. 30

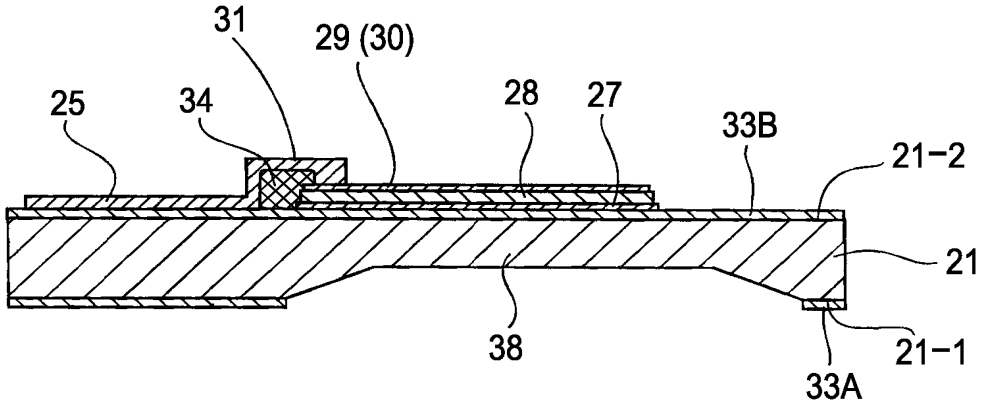

FIG. 31

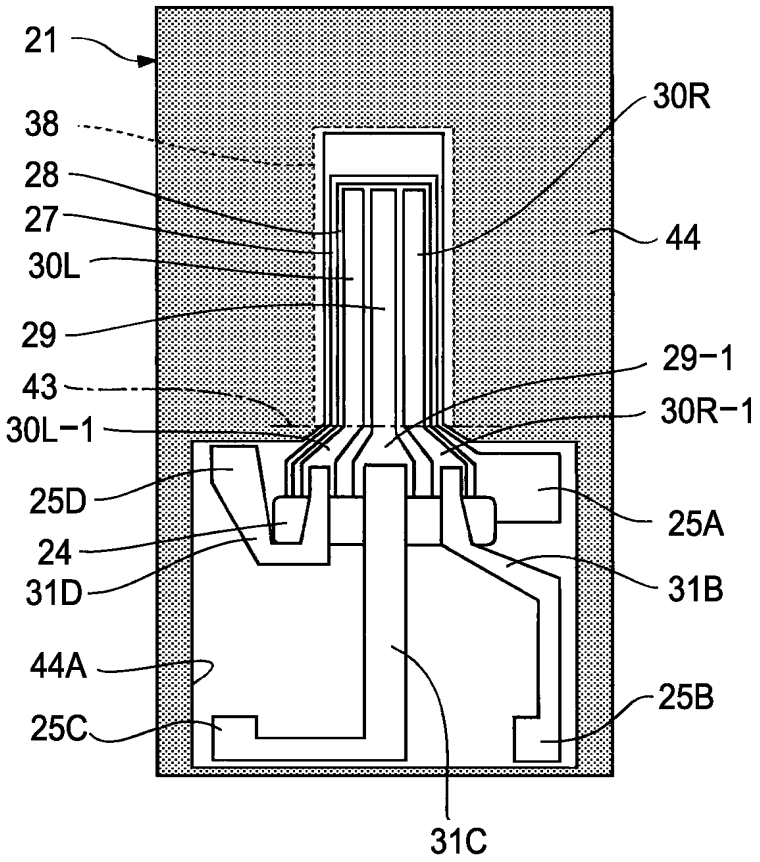
21
38
28
27
30L
29
43
30L-1
25D
24
31D
44A
25C
30R
44
29-1
30R-1
25A
31B
25B
31C

FIG. 32

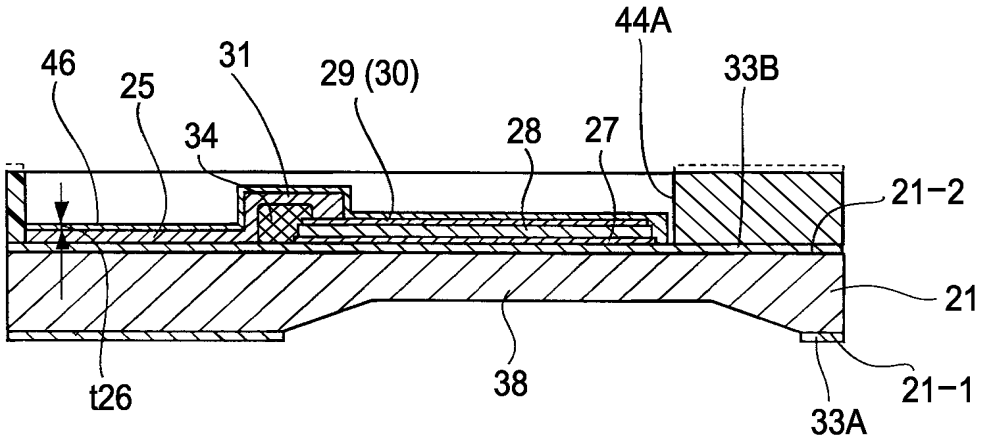

FIG. 33

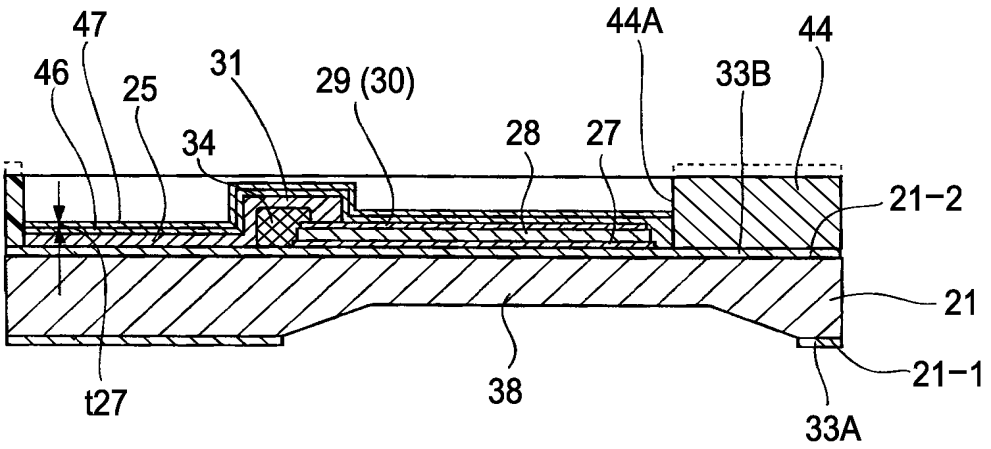

FIG. 34

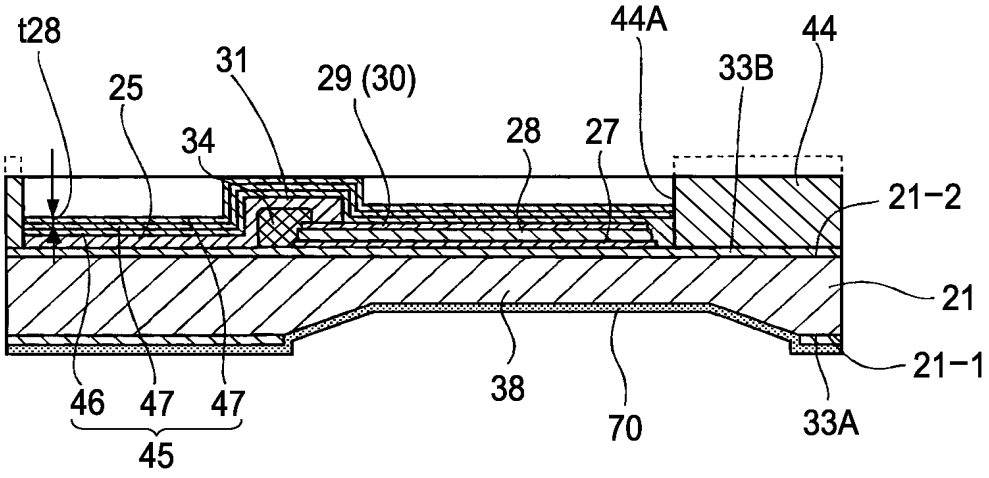

FIG. 35

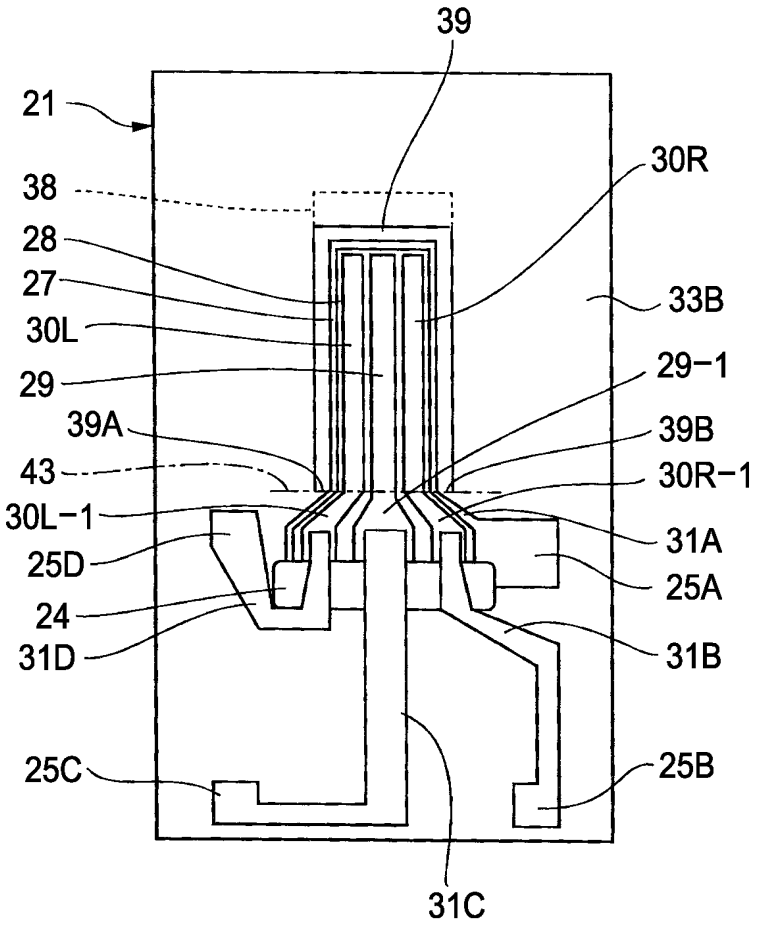
39
21
30R
38
28
27
33B
30L
29-1
29
39A
39B
43
30R-1
30L-1
31A
25D
25A
24
31B
31D
25C
25B
31C

FIG. 36

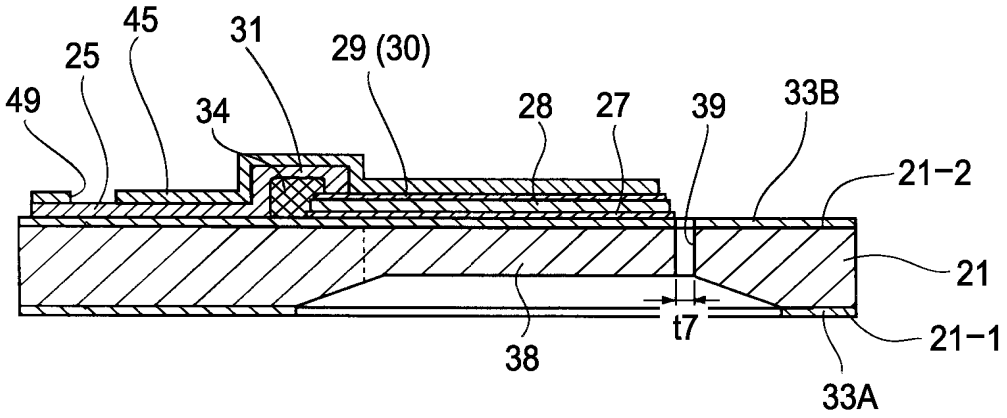

FIG. 37

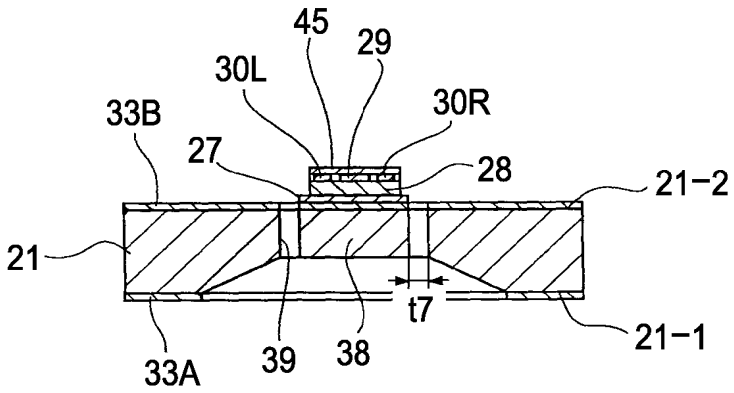

FIG. 38A

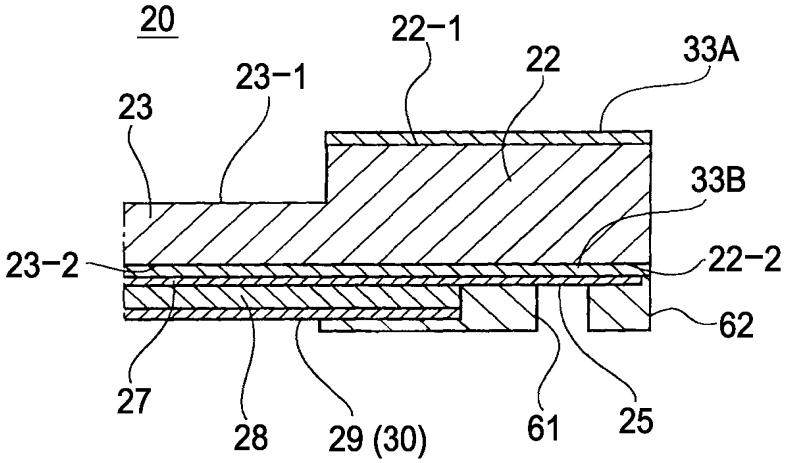

FIG. 38B

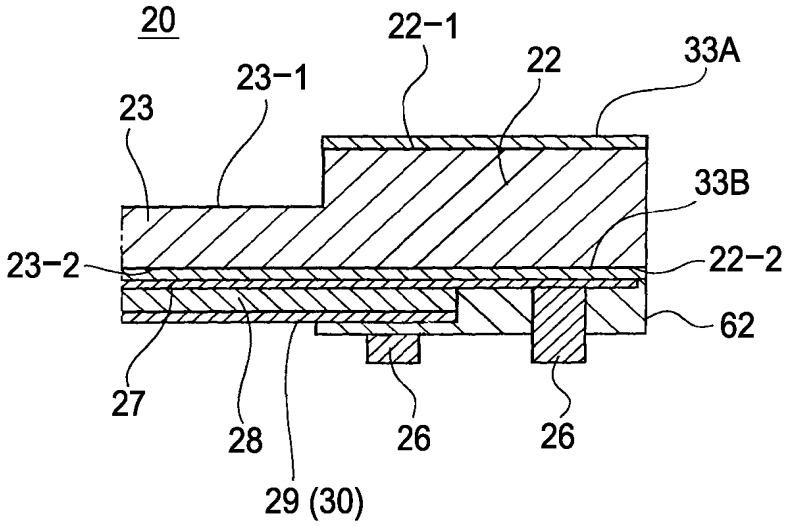

FIG. 39A

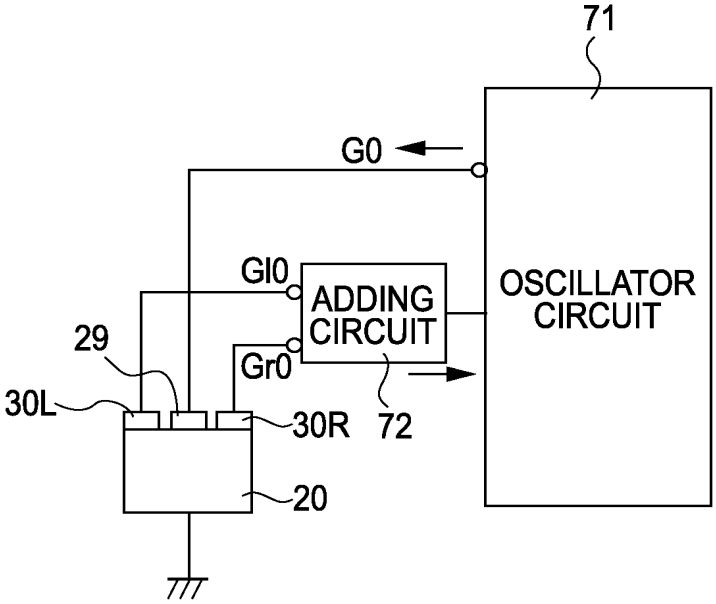

FIG. 39B

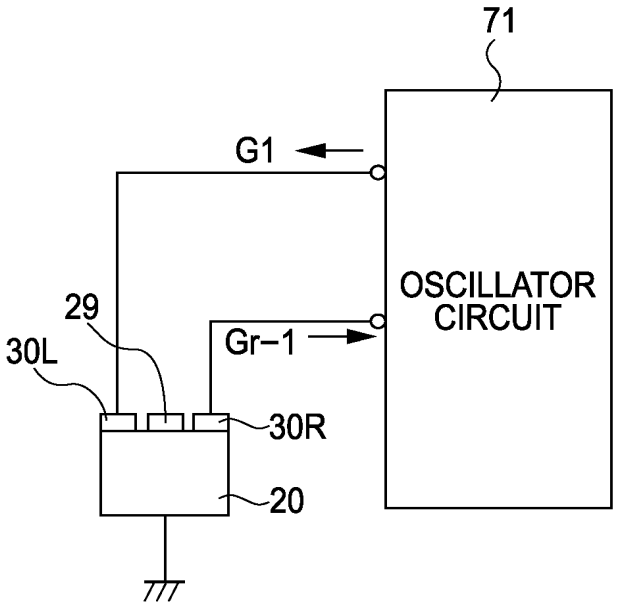

FIG. 39C

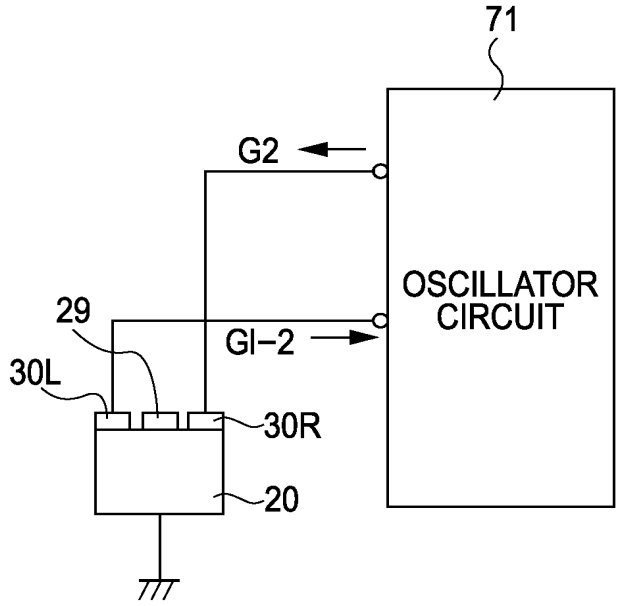

FIG. 40

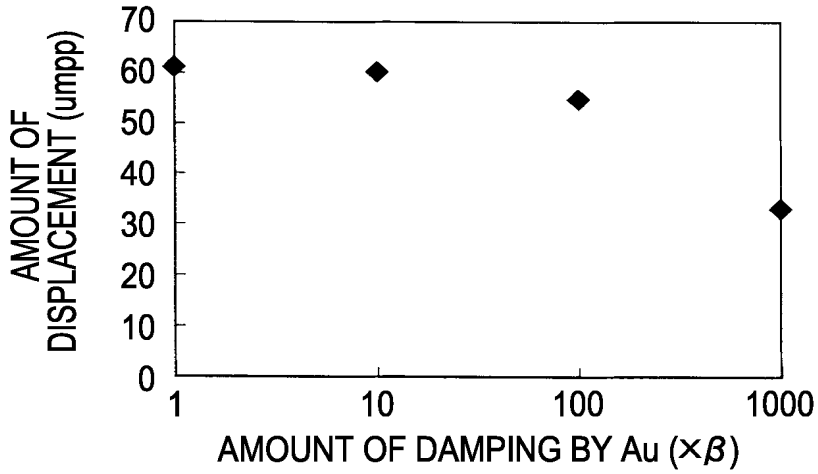

FIG. 41A

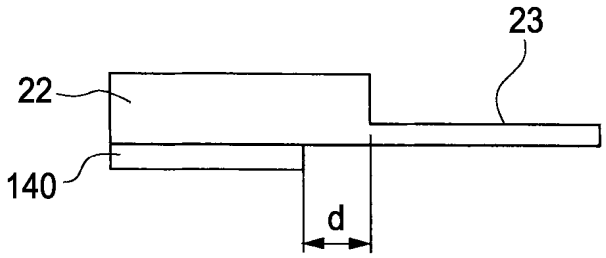

FIG. 41B

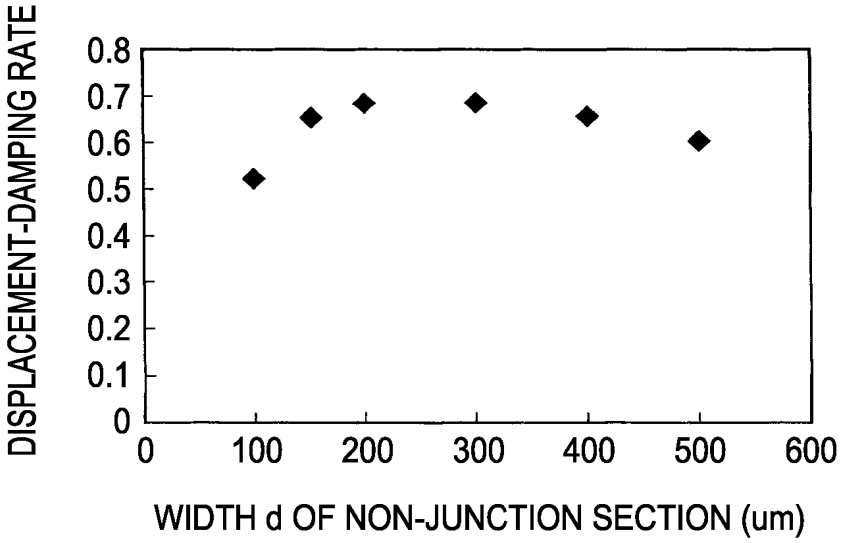

FIG. 42A

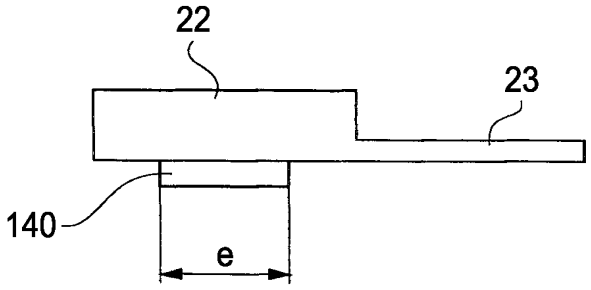

FIG. 42B

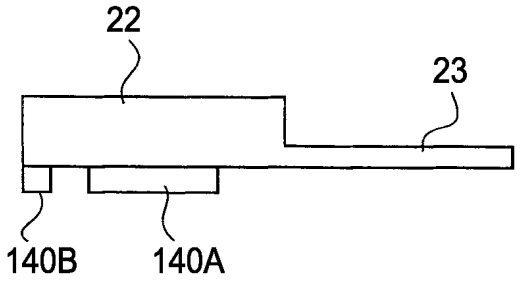

FIG. 42C

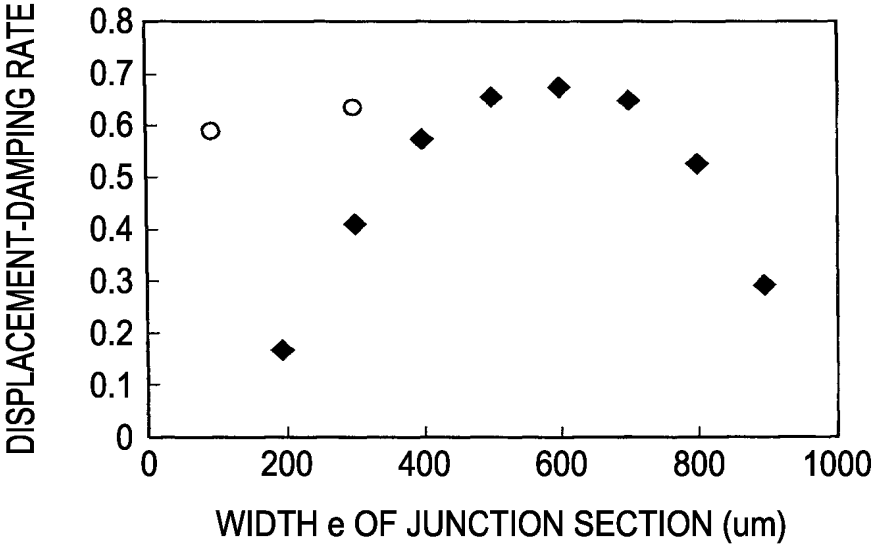

FIG. 43A

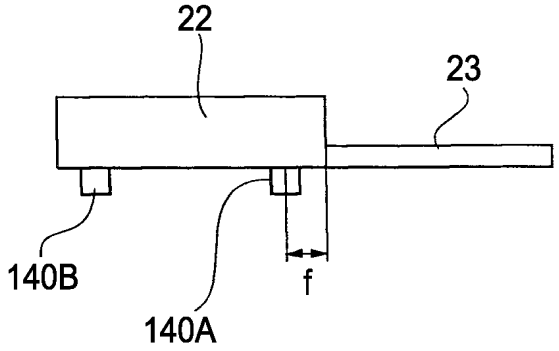

FIG. 43B

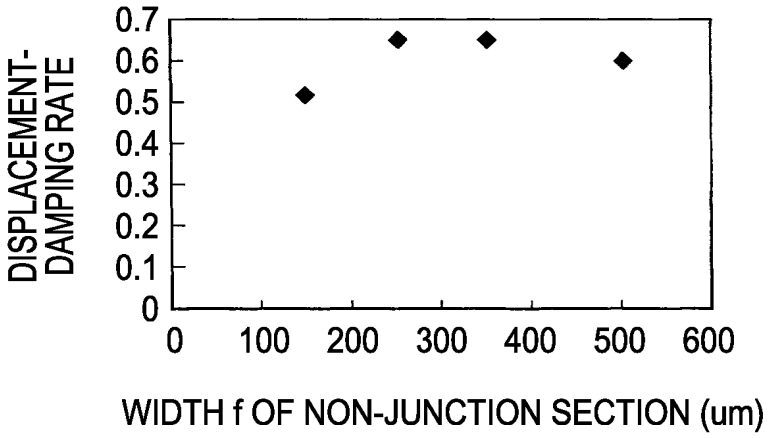

FIG. 44A

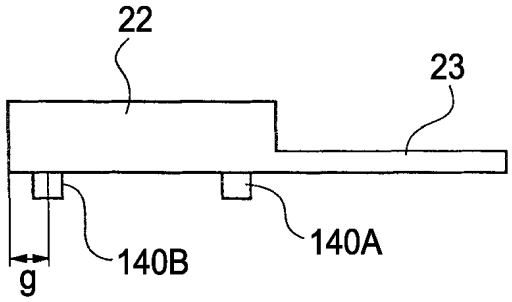

FIG. 44B

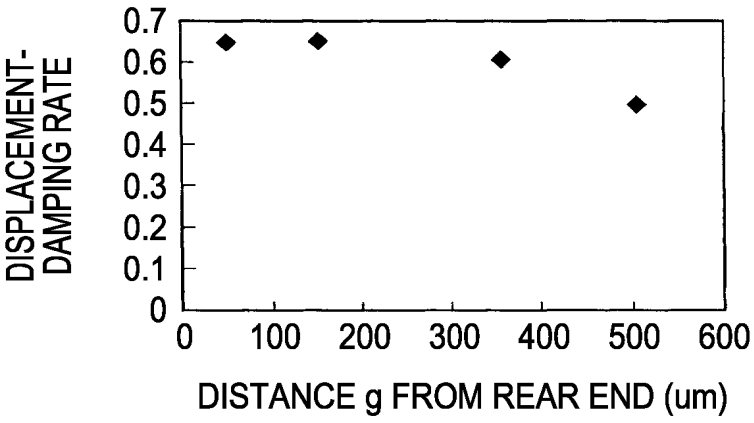
DISPLACEMENT-DAMPING RATE
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
100
200
300
400
500
600
DISTANCE g FROM REAR END (um)

FIG. 45

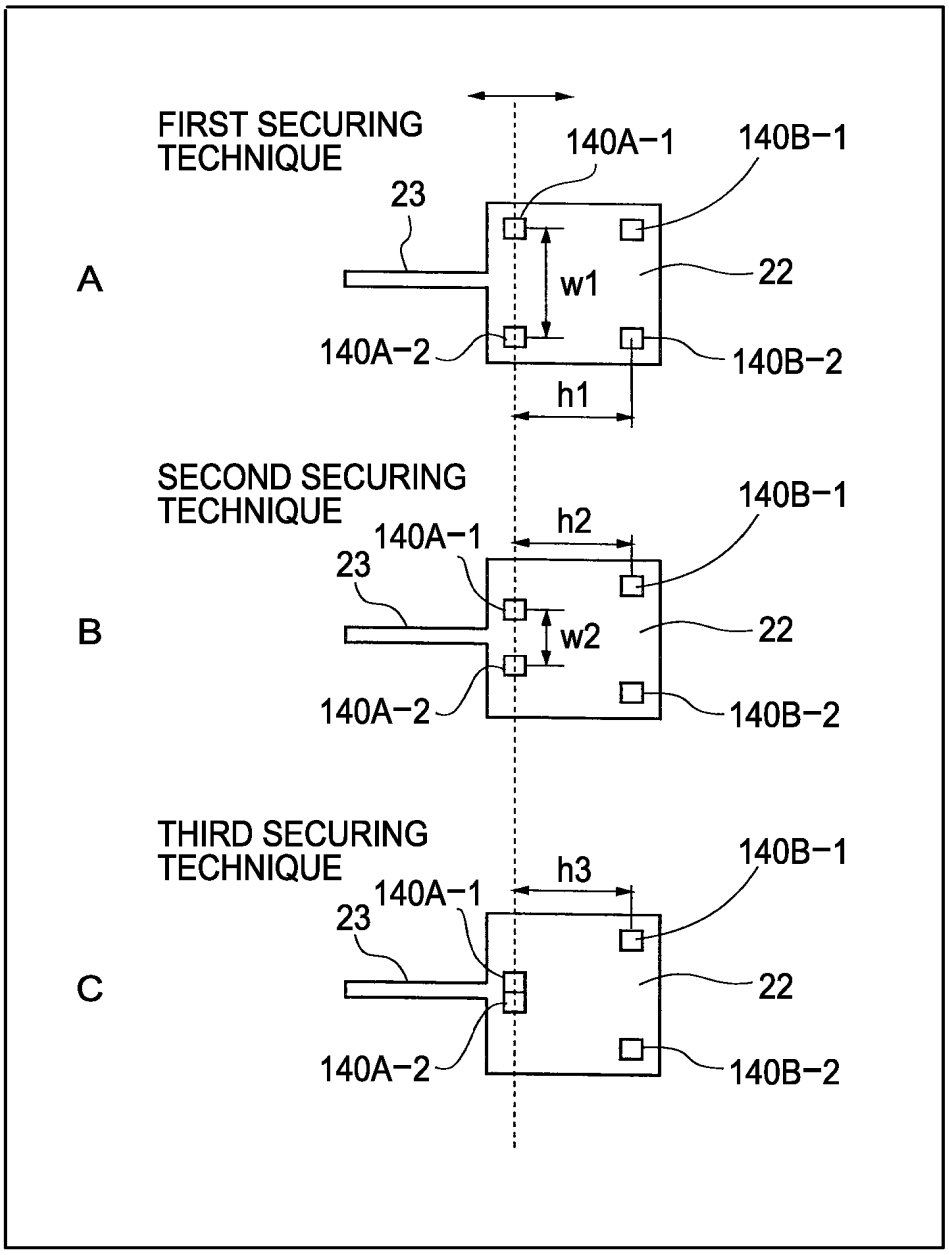
FIRST SECURING TECHNIQUE
A
140A-1
140B-1
23
w1
22
140A-2
140B-2
h1
SECOND SECURING TECHNIQUE
B
h2
140A-1
140B-1
23
w2
22
140A-2
140B-2
THIRD SECURING TECHNIQUE
C
h3
140A-1
140B-1
23
22
140A-2
140B-2

FIG. 46

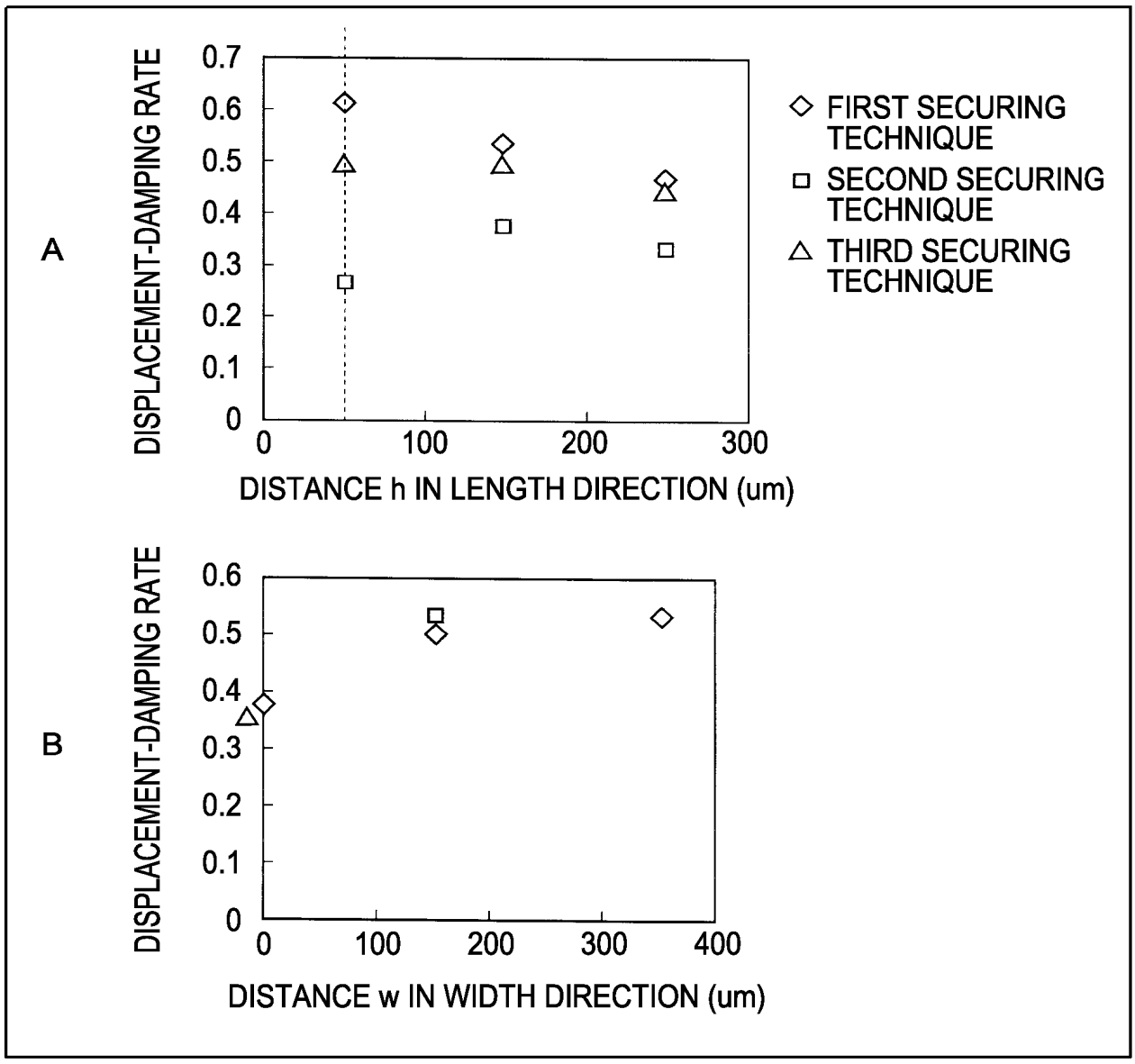

FIG. 47A

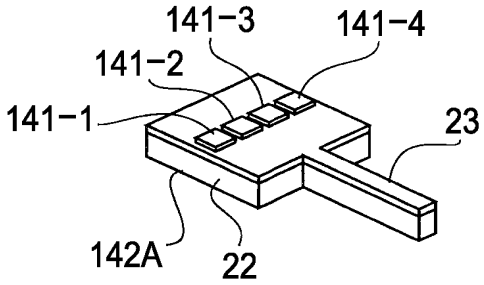

FIG. 47B

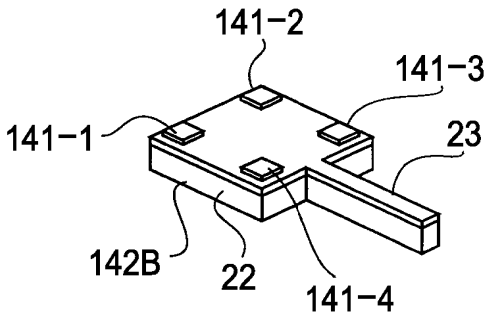

FIG. 47C

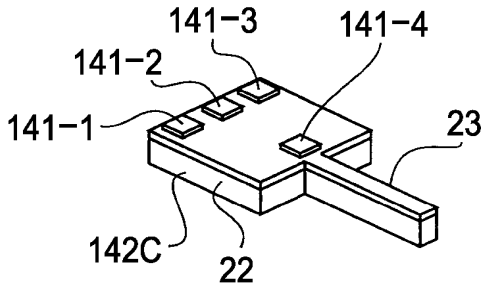

FIG. 48

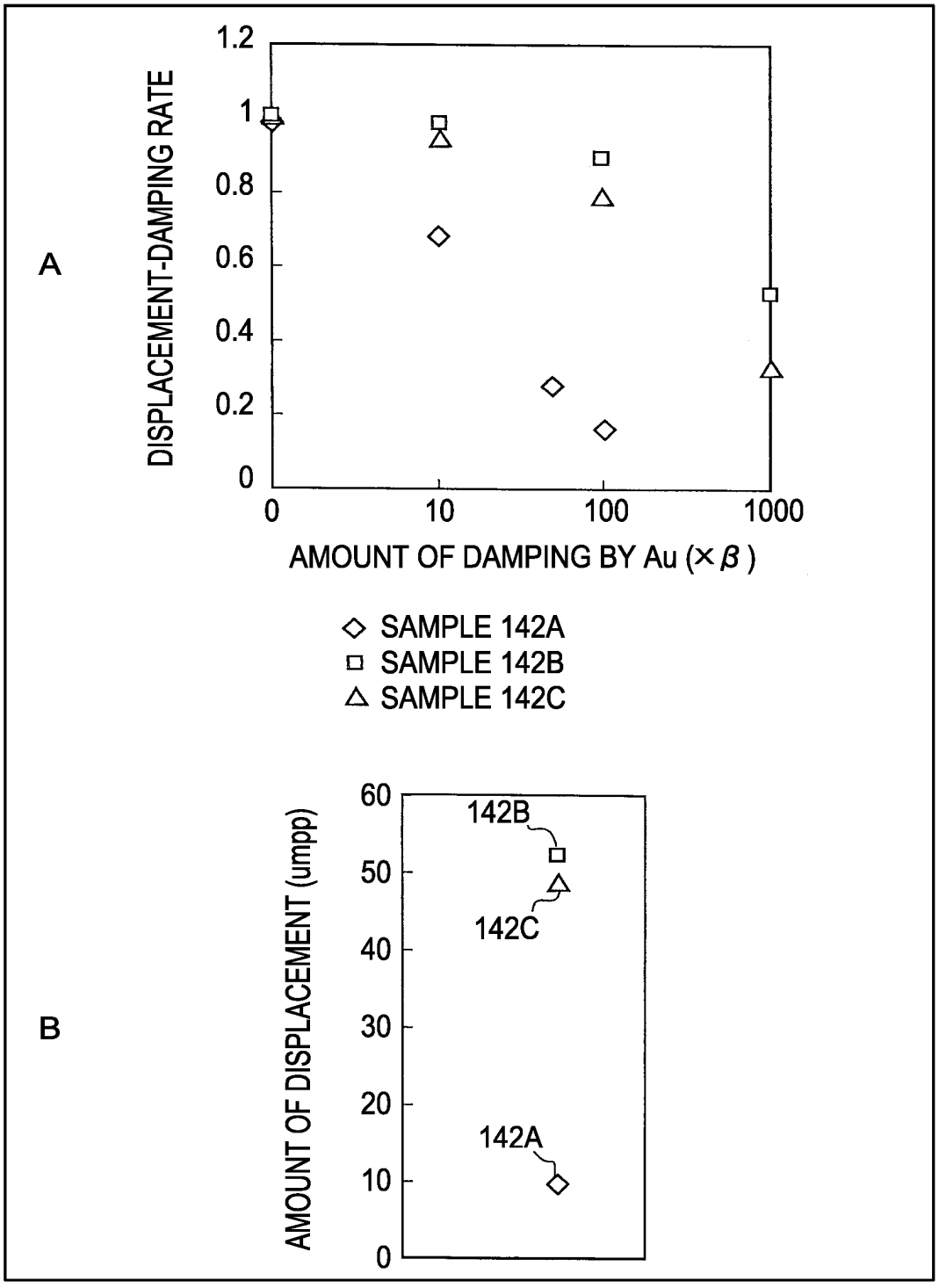
A
DISPLACEMENT-DAMPING RATE
1.2
1
0.8
0.6
0.4
0.2
0
0
10
100
1000
AMOUNT OF DAMPING BY Au (×β)
SAMPLE 142A
SAMPLE 142B
SAMPLE 142C
B
AMOUNT OF DISPLACEMENT (umpp)
60
50
40
30
20
10
0
142B
142C
142A

FIG. 49A

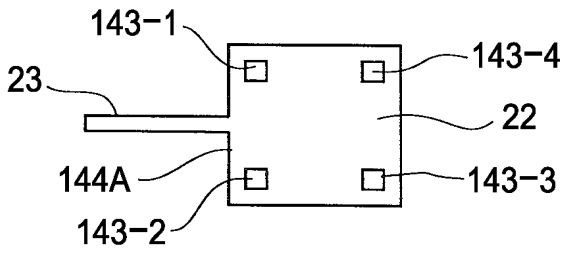

FIG. 49B

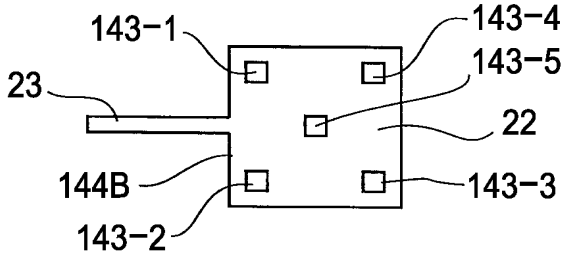

FIG. 49C

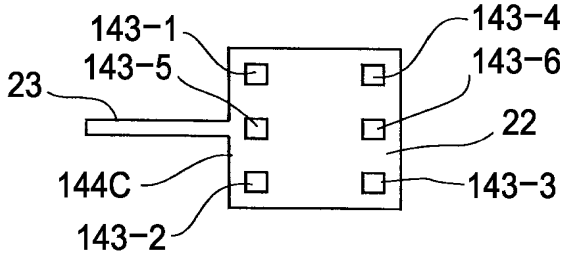

FIG. 49D

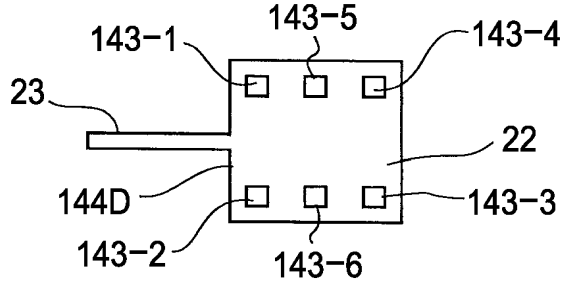

FIG. 50

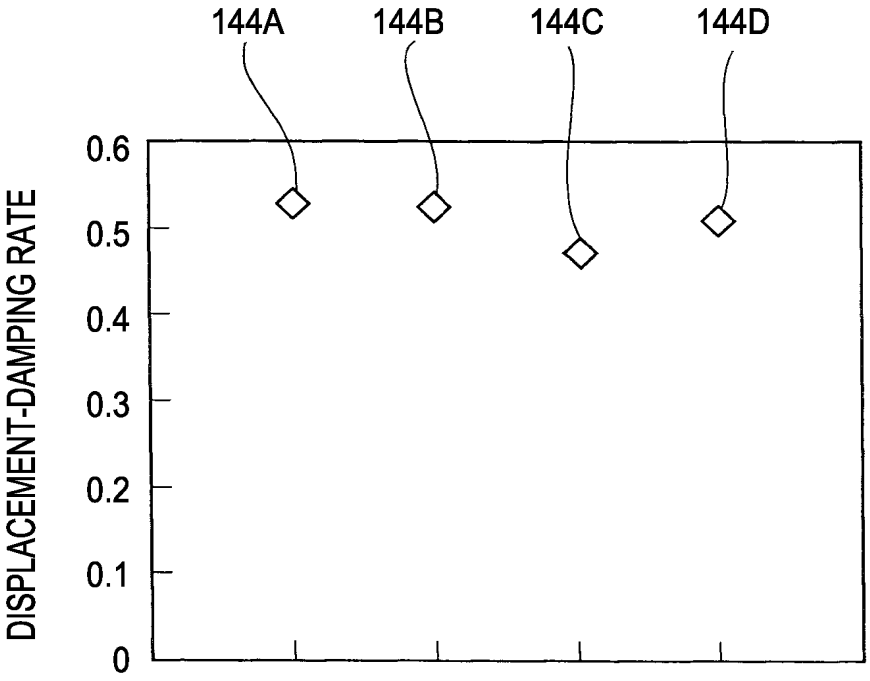
144A
144B
144C
144D
DISPLACEMENT-DAMPING RATE
0.6
0.5
0.4
0.3
0.2
0.1
0

FIG. 51

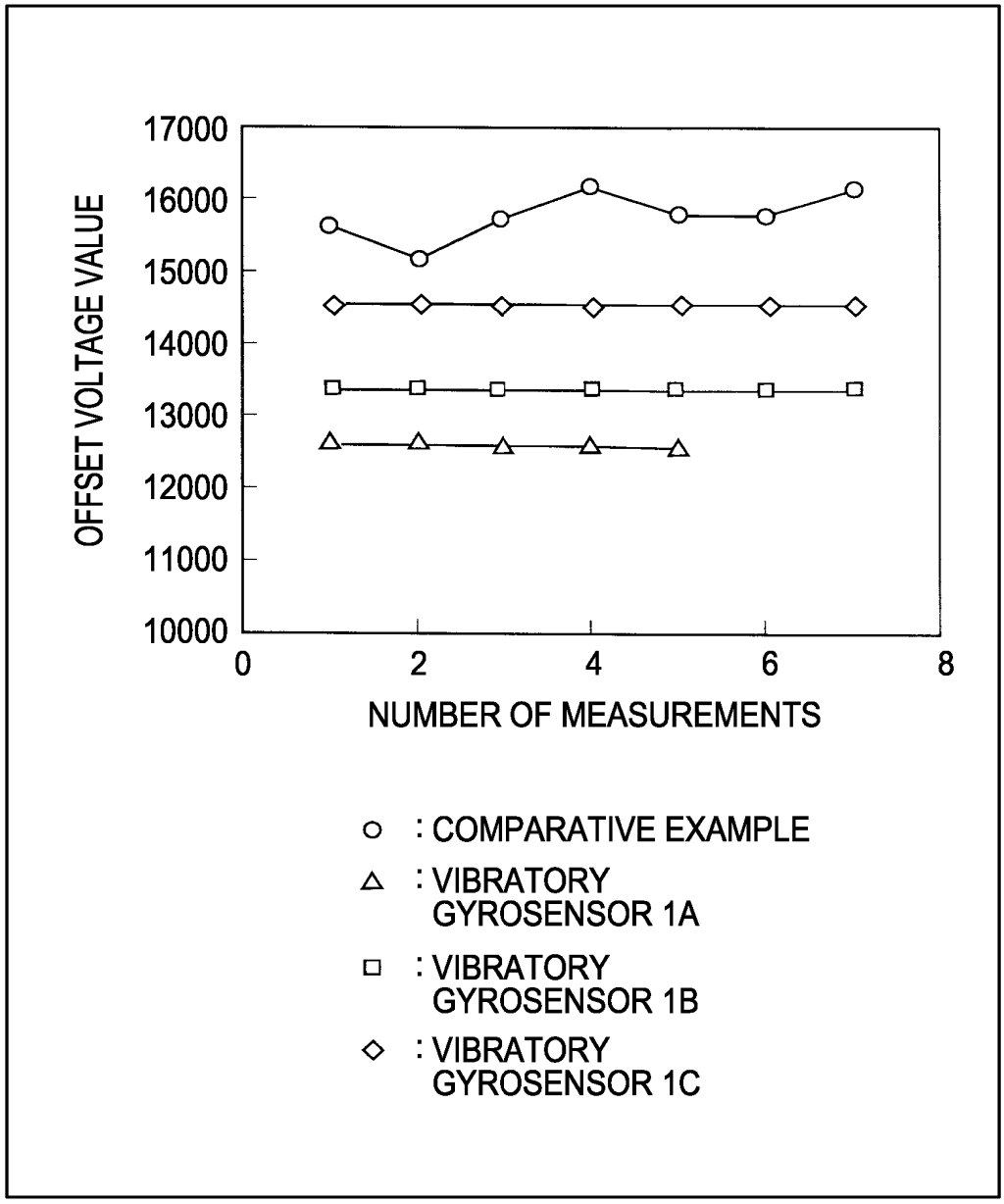
17000
16000
15000
14000
13000
12000
11000
10000
OFFSET VOLTAGE VALUE
0
2
4
6
8
NUMBER OF MEASUREMENTS
○ : COMPARATIVE EXAMPLE
△ : VIBRATORY GYROSENSOR 1A
□ : VIBRATORY GYROSENSOR 1B
◇ : VIBRATORY GYROSENSOR 1C

FIG. 52

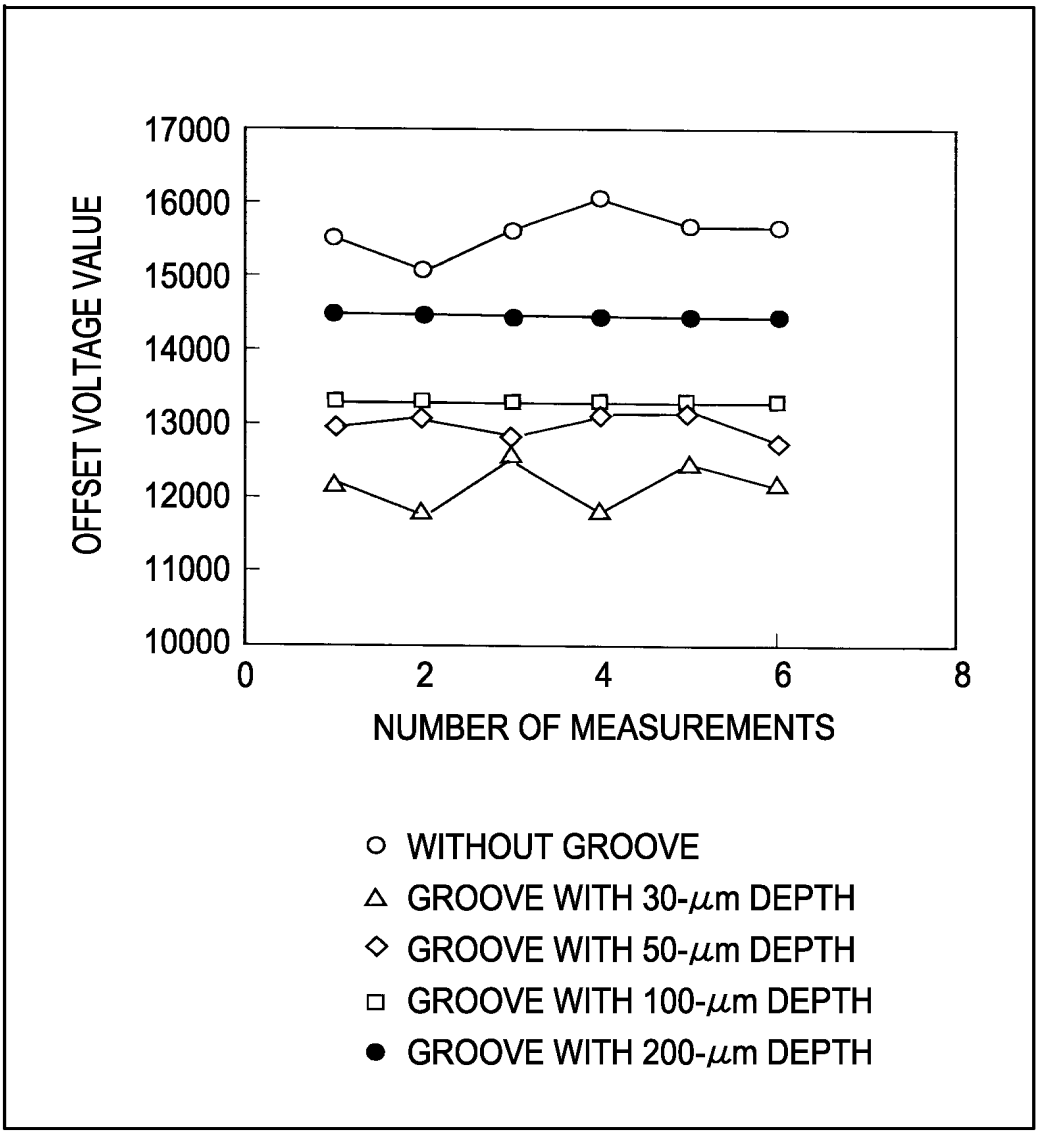
17000
16000
15000
14000
13000
12000
11000
10000
OFFSET VOLTAGE VALUE
0
2
4
6
8
NUMBER OF MEASUREMENTS
WITHOUT GROOVE
GROOVE WITH 30-μm DEPTH
GROOVE WITH 50-μm DEPTH
GROOVE WITH 100-μm DEPTH
GROOVE WITH 200-μm DEPTH

FIG. 53

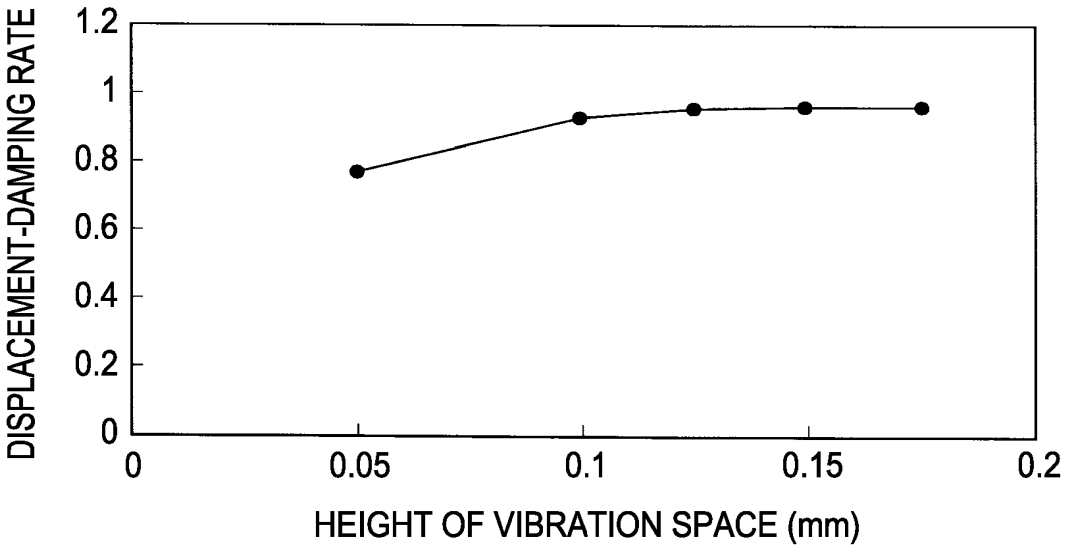
DISPLACEMENT-DAMPING RATE
1.2
1
0.8
0.6
0.4
0.2
0
0
0.05
0.1
0.15
0.2
HEIGHT OF VIBRATION SPACE (mm)

FIG. 54

	3cm-SQUARE SUBSTRATE	4in-ϕ SUBSTRATE	5in-ϕ SUBSTRATE
ONE-AXIS VIBRATION ELEMENTS	60 (30)	1200 (600)	4000 (2000)
TWO-AXIS INTEGRATED VIBRATION ELEMENTS	20	300	800

FIG. 55

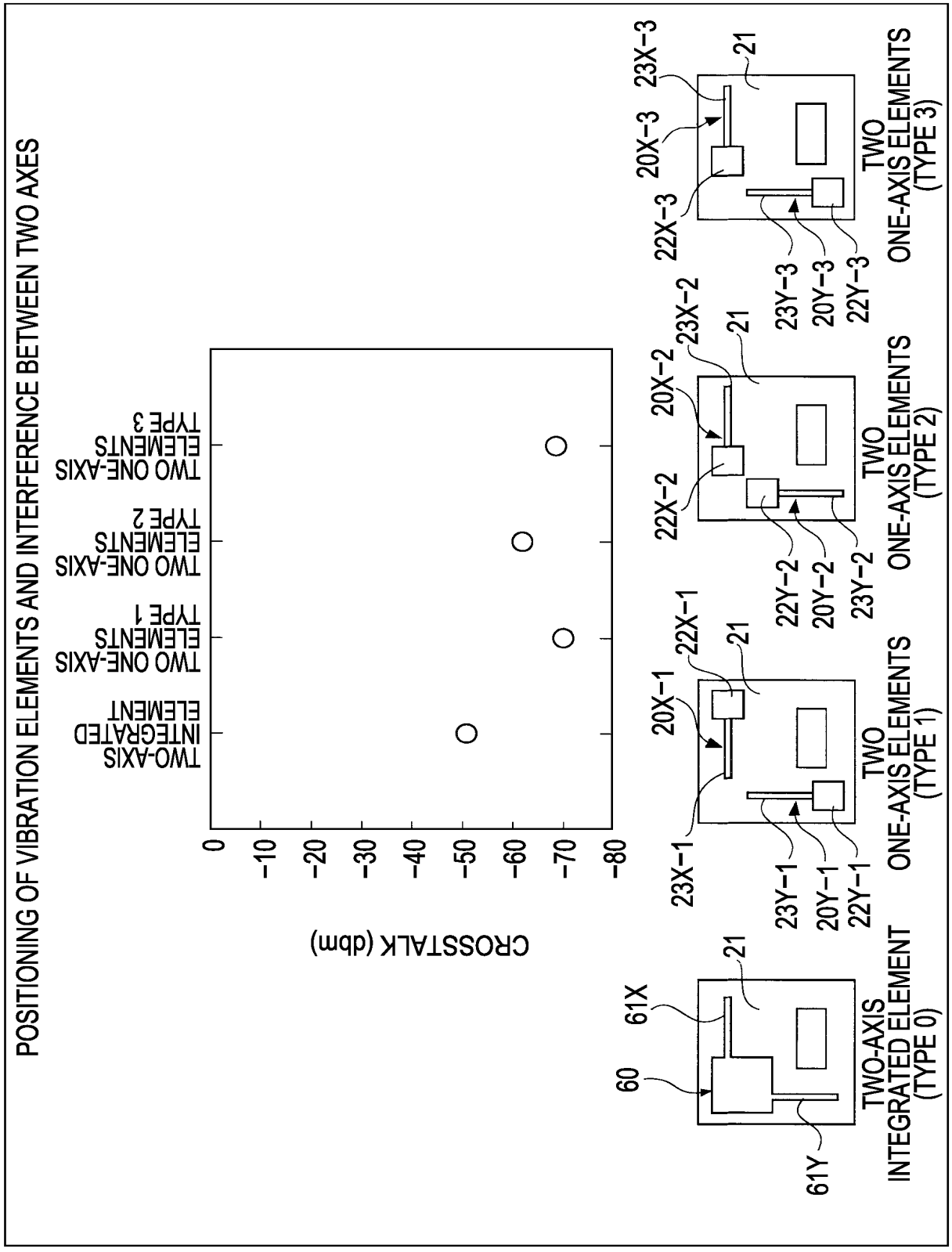
POSITIONING OF VIBRATION ELEMENTS AND INTERFERENCE BETWEEN TWO AXES
CROSSTALK (dbm)
0
-10
-20
-30
-40
-50
-60
-70
-80
TWO-AXIS INTEGRATED ELEMENT
TWO ONE-AXIS ELEMENTS TYPE 1
TWO ONE-AXIS ELEMENTS TYPE 2
TWO ONE-AXIS ELEMENTS TYPE 3
TWO-AXIS INTEGRATED ELEMENT (TYPE 0)
TWO ONE-AXIS ELEMENTS (TYPE 1)
TWO ONE-AXIS ELEMENTS (TYPE 2)
TWO ONE-AXIS ELEMENTS (TYPE 3)
60
61X
61Y
21
23X-1
22X-1
20X-1
23Y-1
22Y-1
20Y-1
23X-2
22X-2
20X-2
23Y-2
22Y-2
20Y-2
23X-3
22X-3
20X-3
23Y-3
22Y-3
20Y-3

FIG. 56A

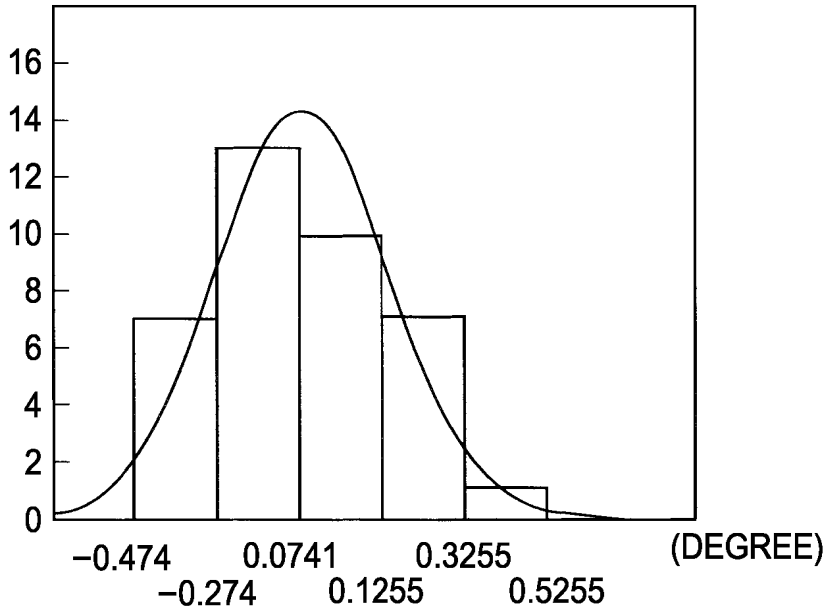

FIG. 56B

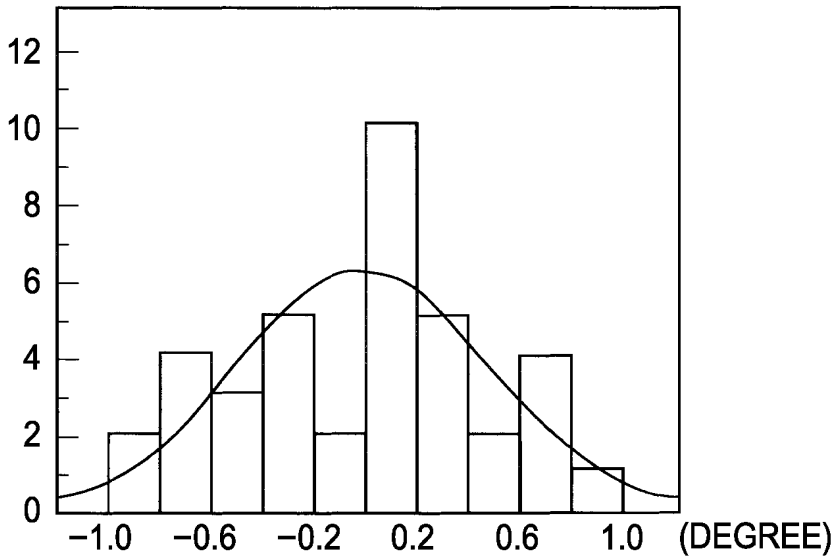

FIG. 57

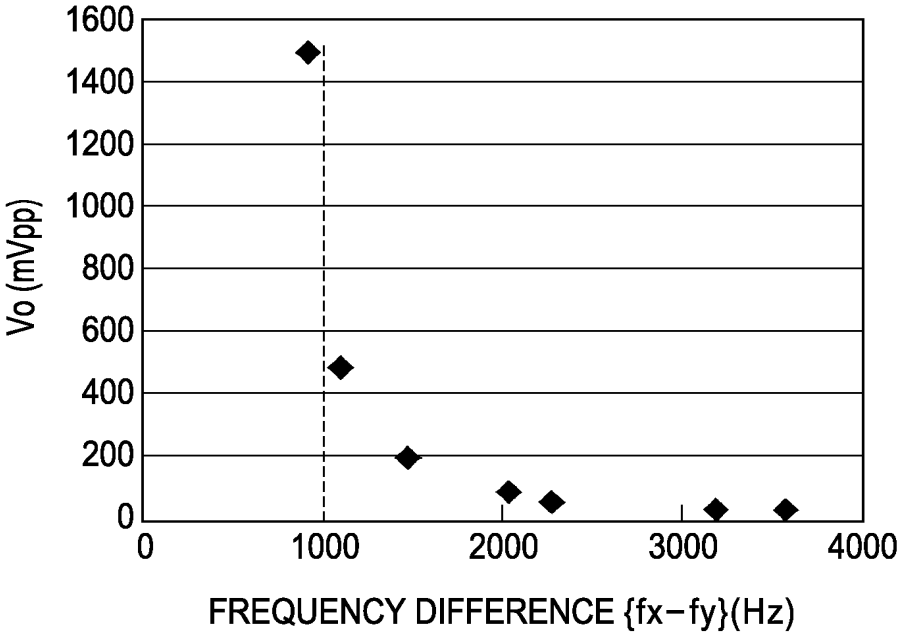
1600
1400
1200
1000
800
600
400
200
0
Vo (mVpp)
0
1000
2000
3000
4000
FREQUENCY DIFFERENCE {fx−fy}(Hz)

FIG. 58

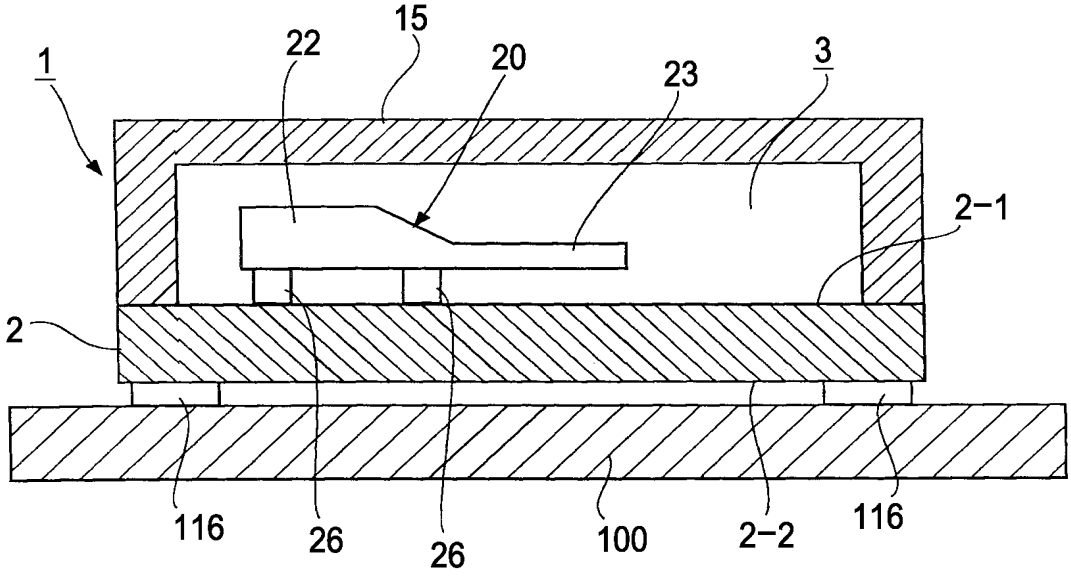
1
22
15
20
23
3
2−1
2
116
26
26
100
2−2
116

FIG. 59

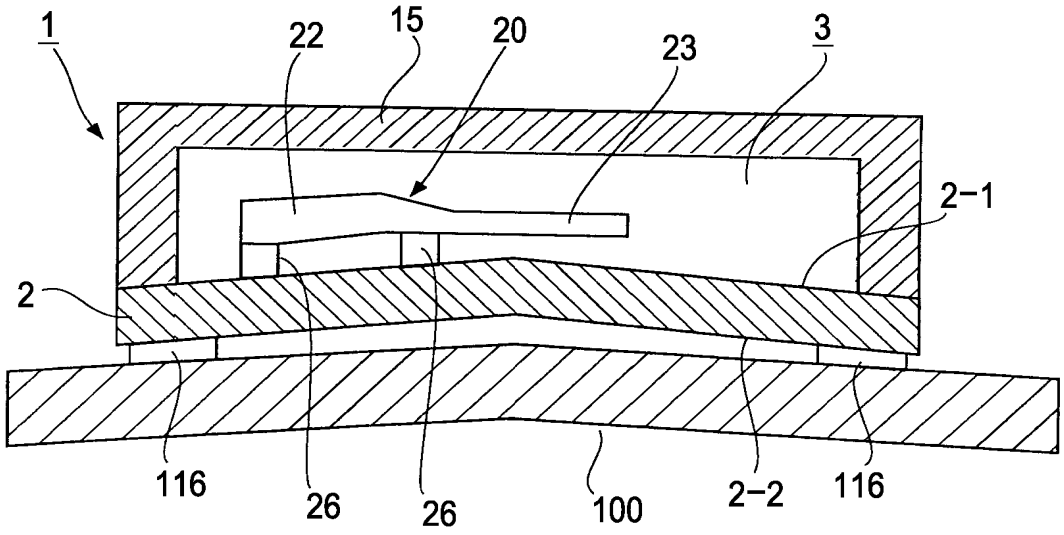

FIG. 60A

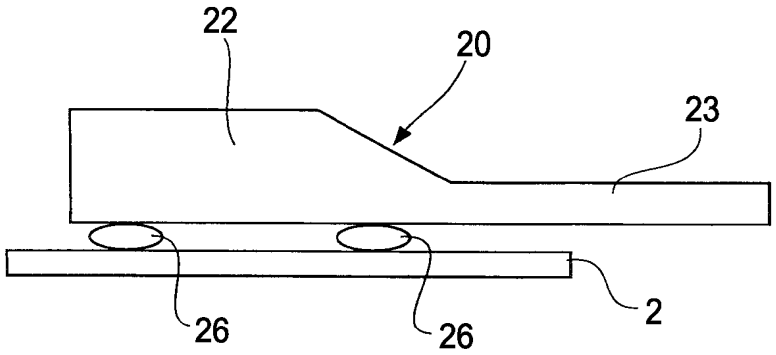

FIG. 60B

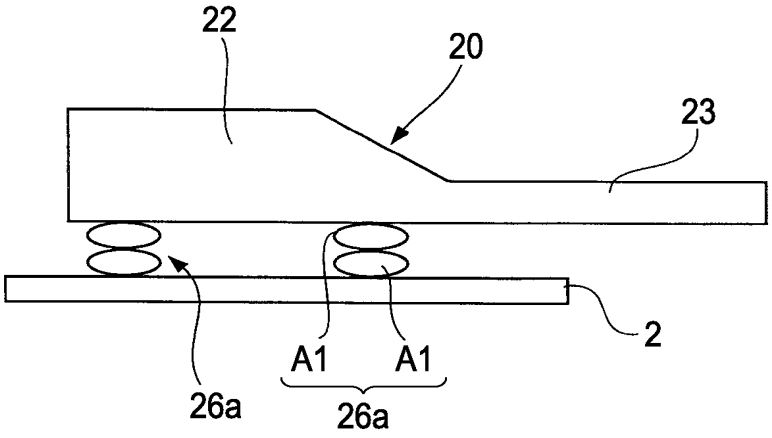

FIG. 61A

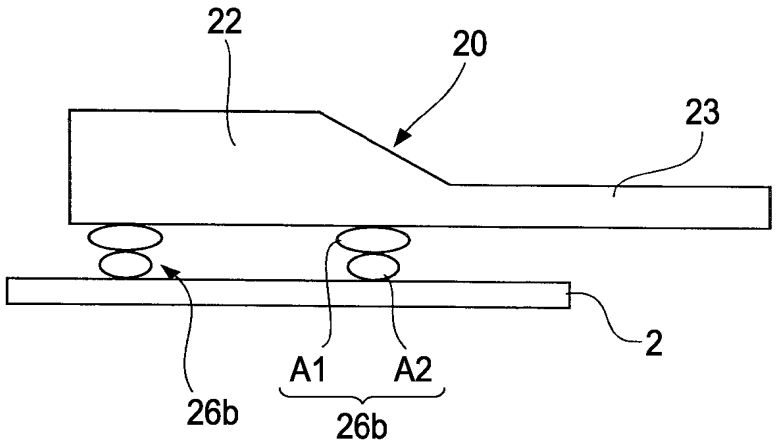

FIG. 61B

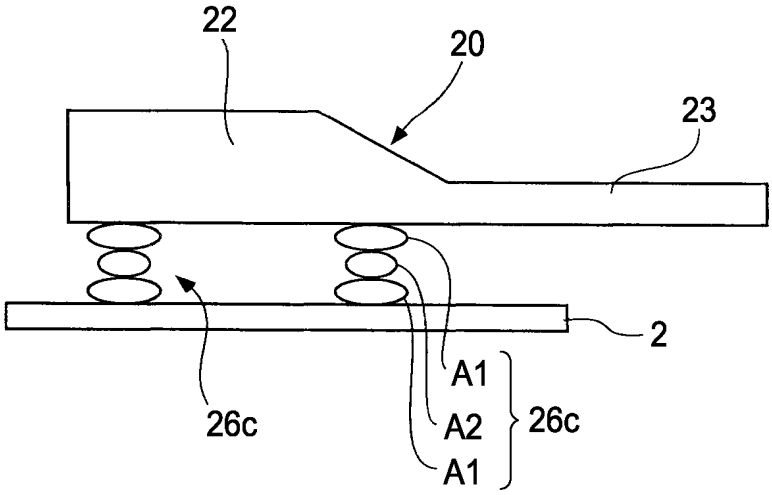

FIG. 62A

	LARGE (A1)	SMALL (A2)
WIDTH OF GOLD WIRE (μm)	38	25
BALL DIAMETER (μm)	130	90

FIG. 62B

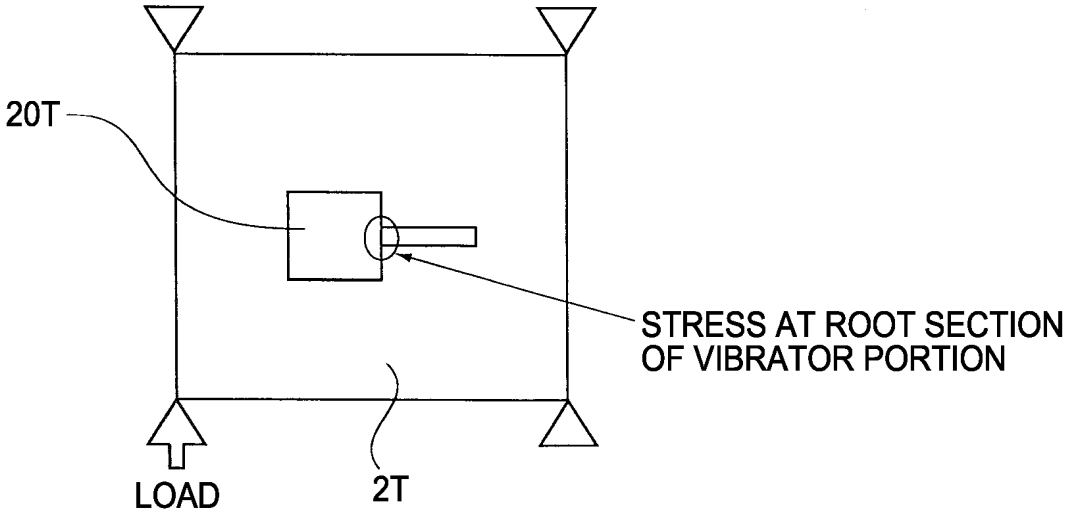

FIG. 63A

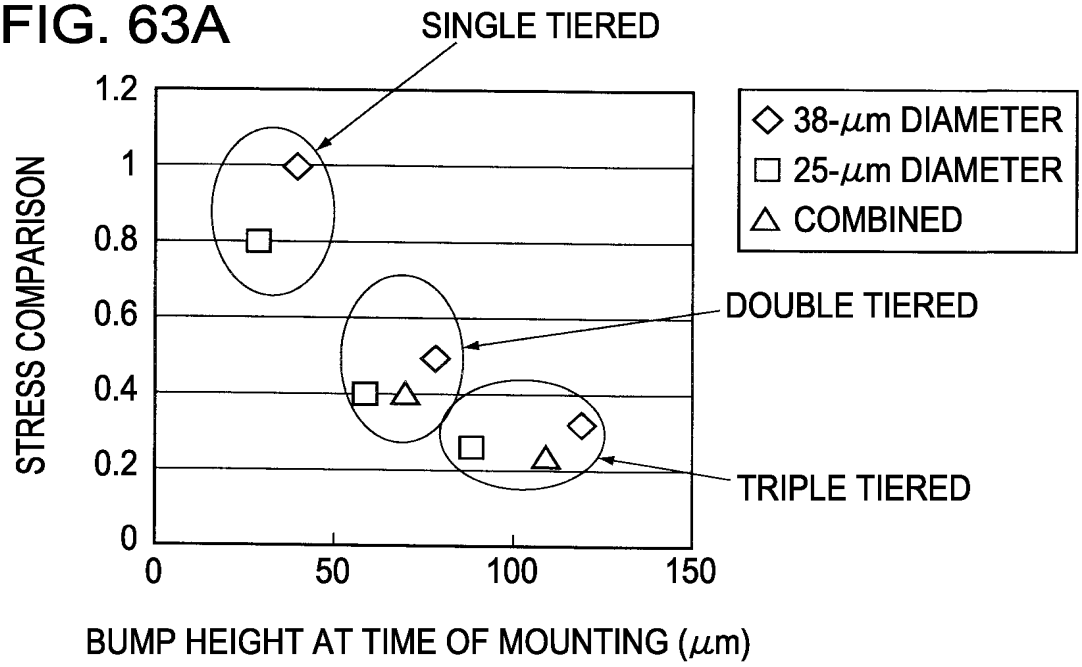

FIG. 63B

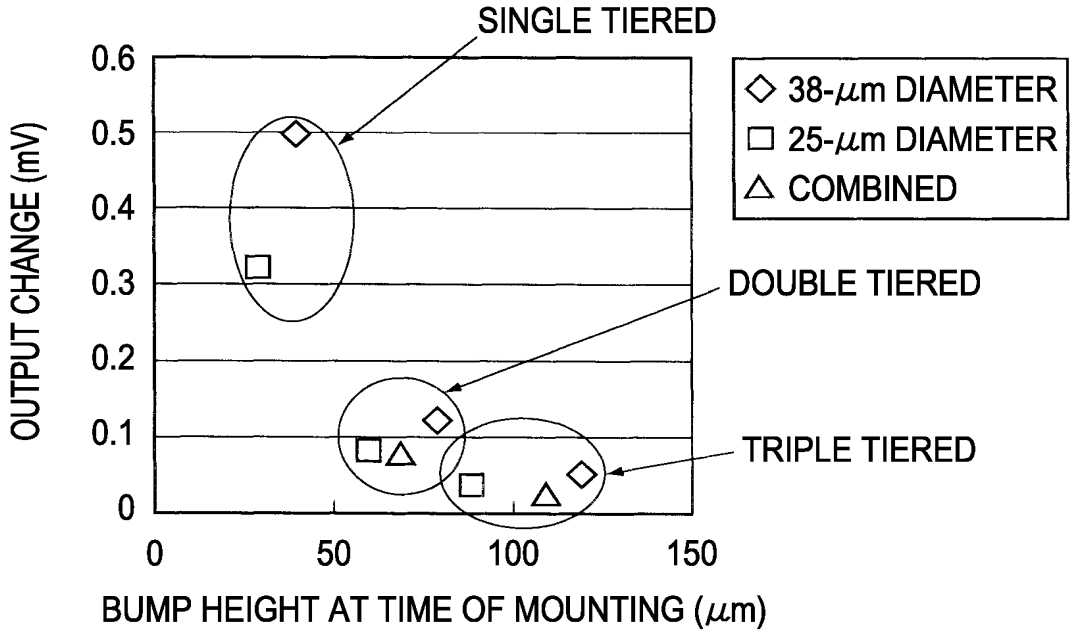

FIG. 64A

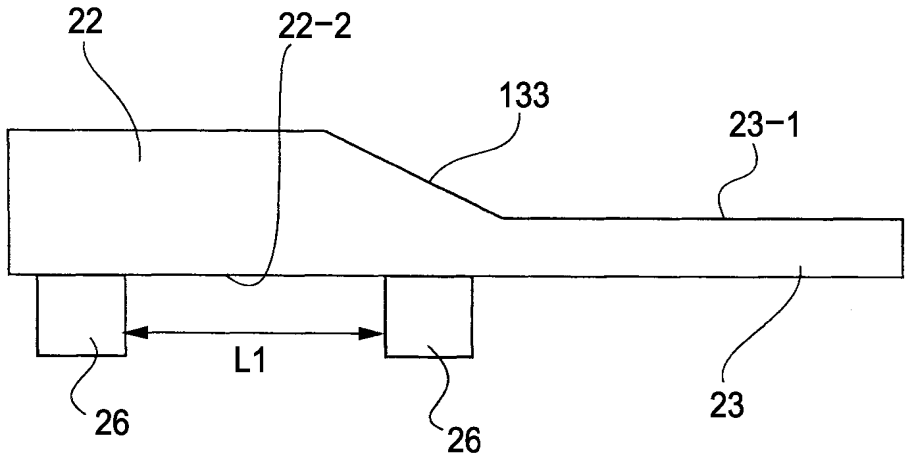

FIG. 64B

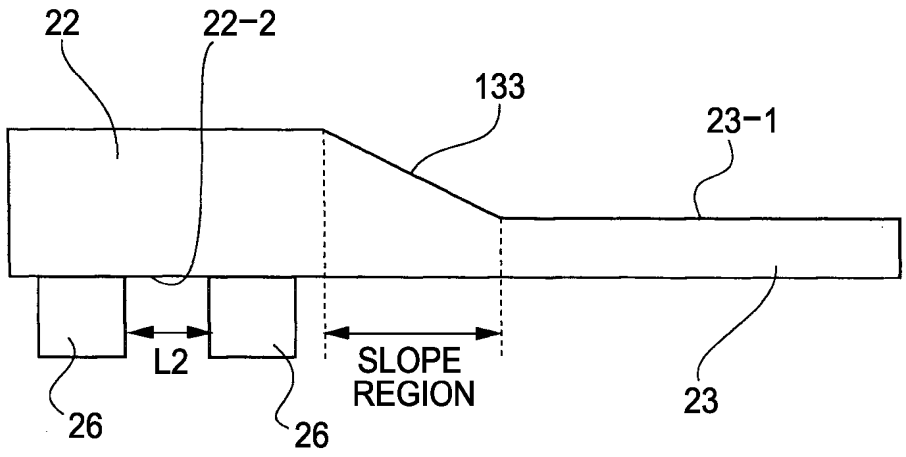

FIG. 65

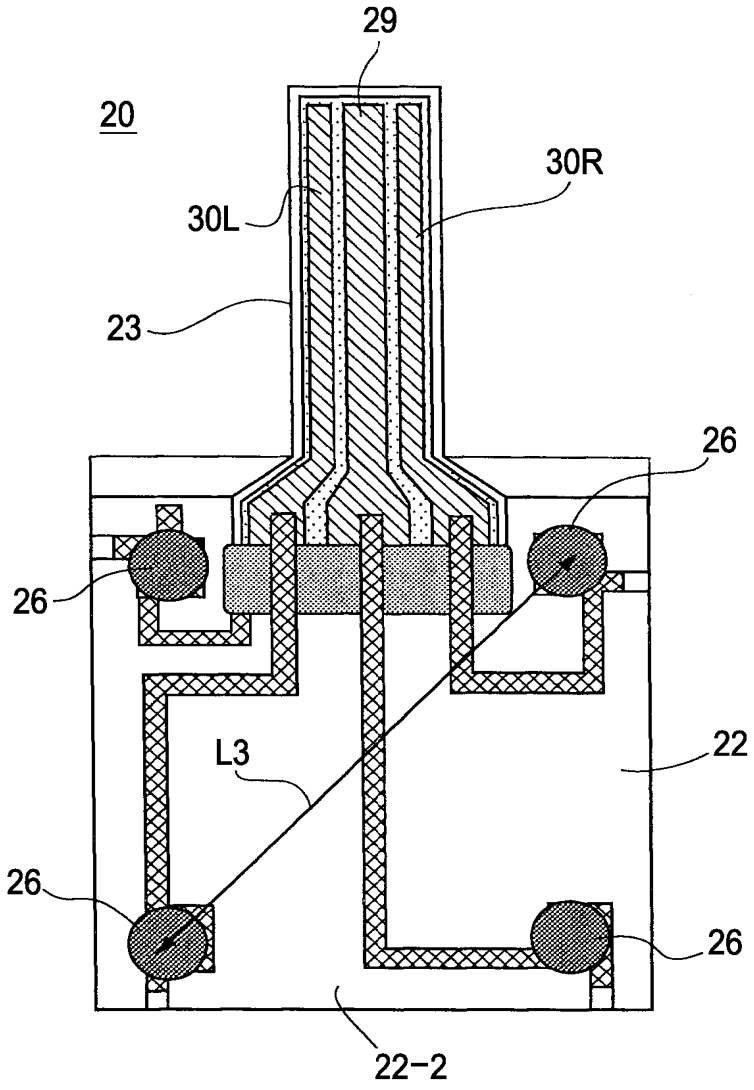

FIG. 66

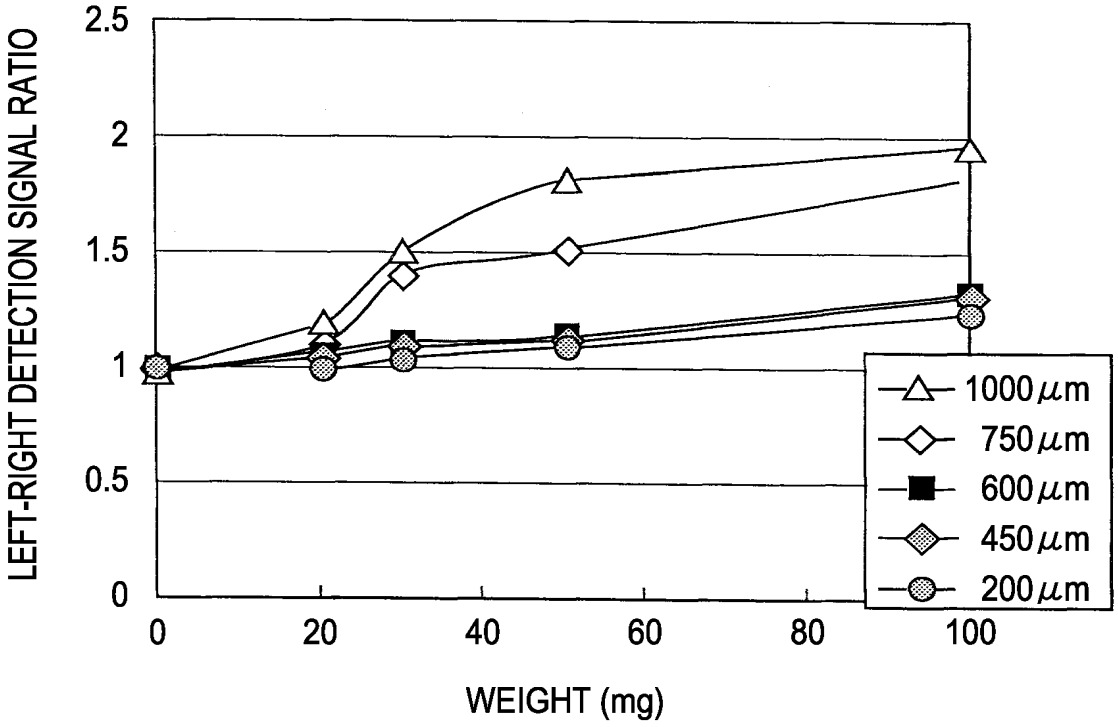
LEFT-RIGHT DETECTION SIGNAL RATIO
2.5
2
1.5
1
0.5
0
0
20
40
60
80
100
WEIGHT (mg)
1000μm
750μm
600μm
450μm
200μm

FIG. 67

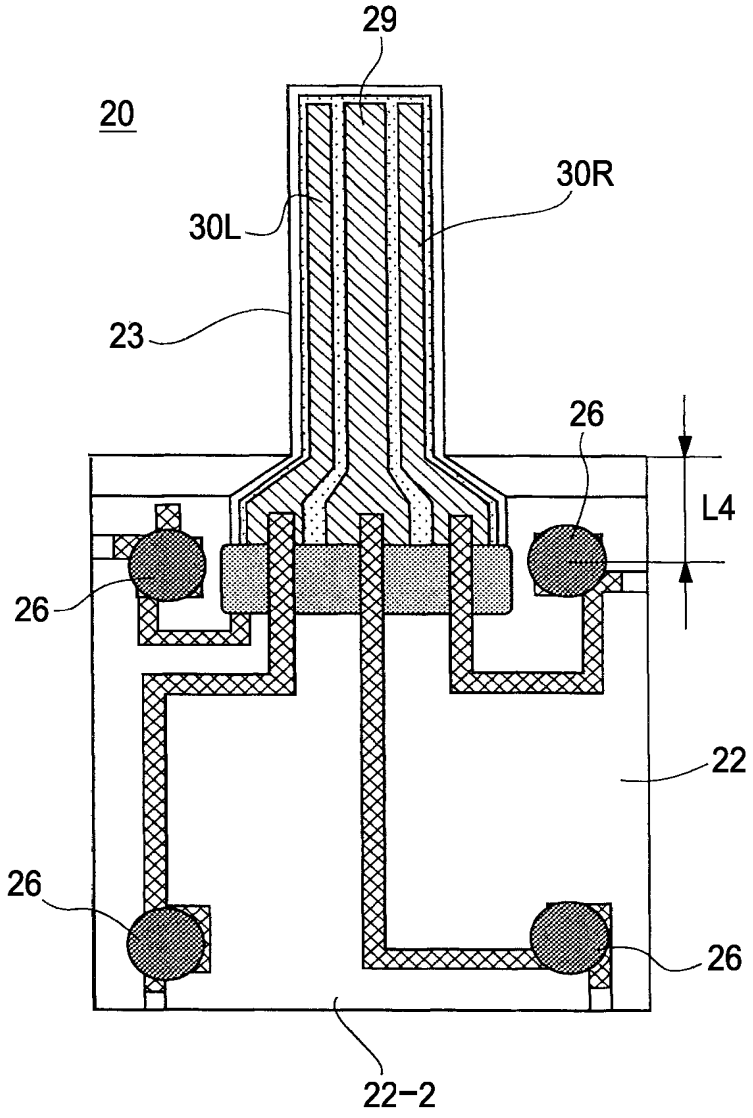

FIG. 68

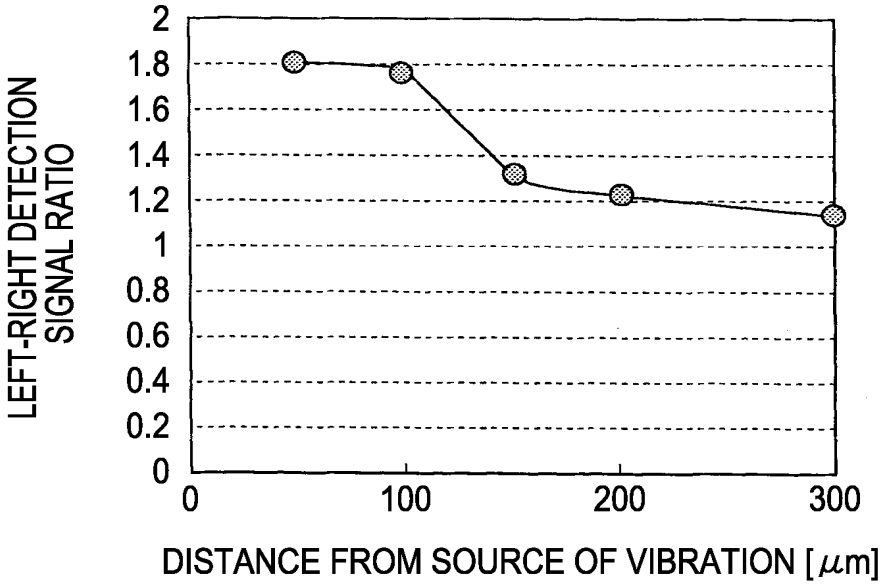
LEFT-RIGHT DETECTION SIGNAL RATIO
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
DISTANCE FROM SOURCE OF VIBRATION [μm]

FIG. 69

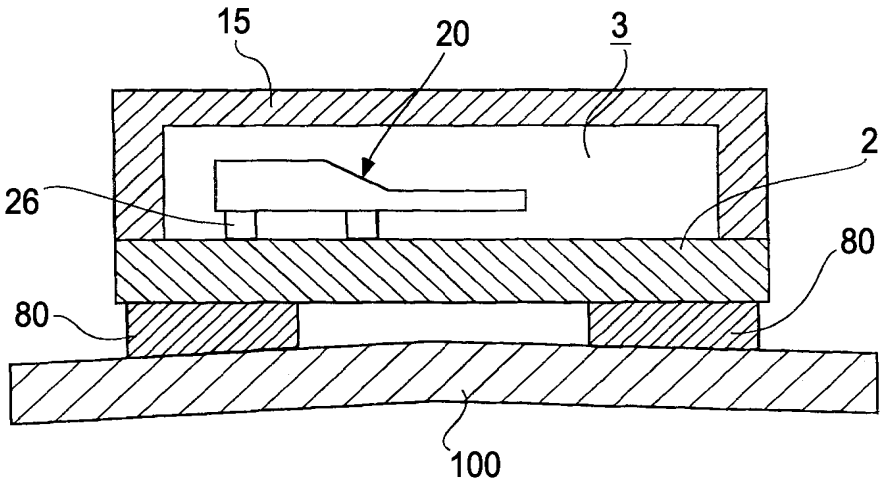
15
20
3
2
26
80
80
100

FIG. 70

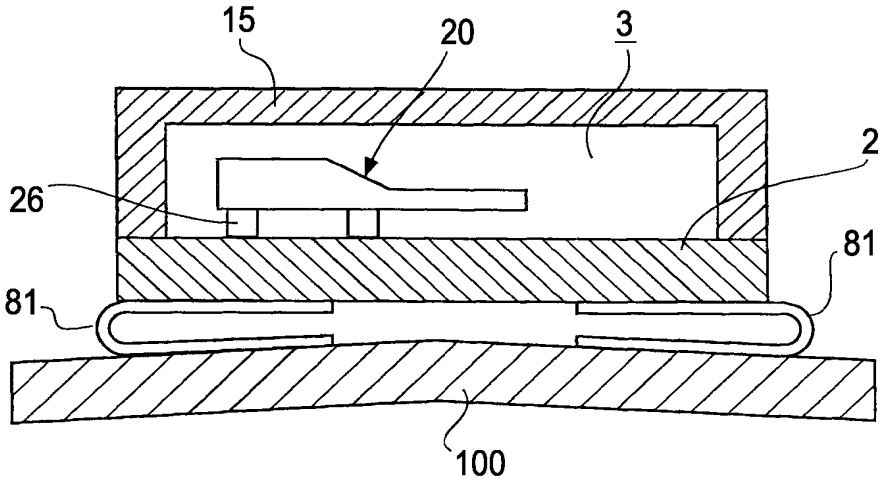

FIG. 71

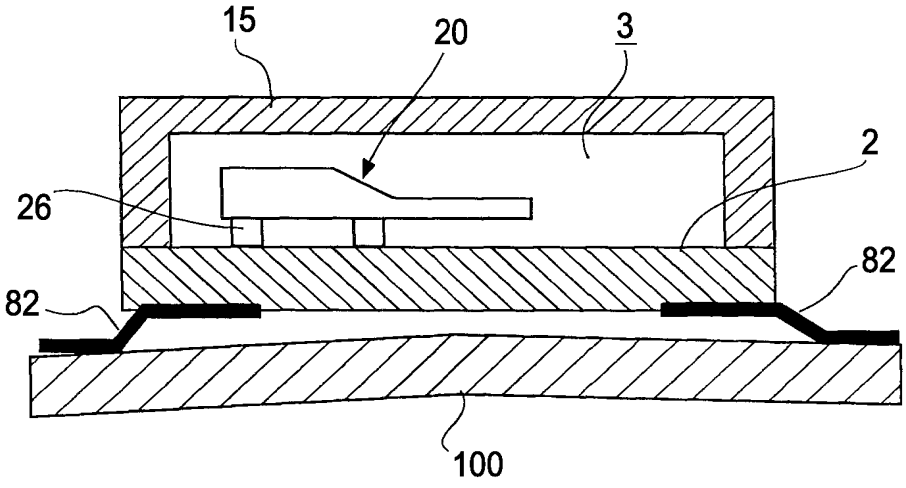

FIG. 72

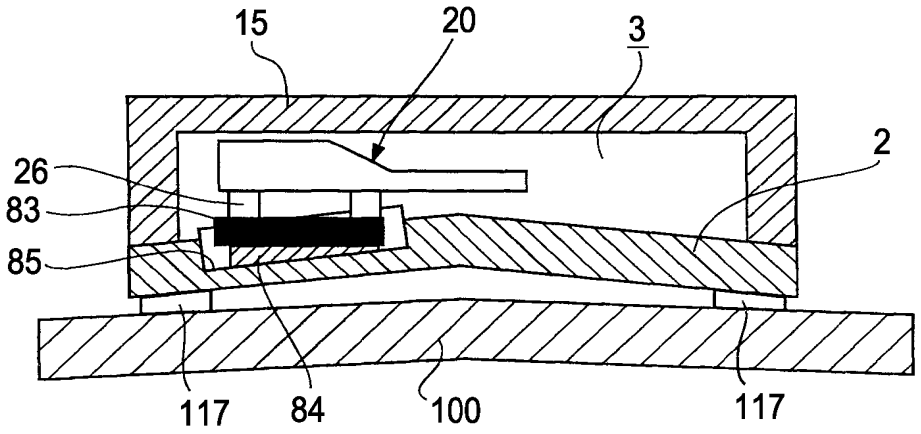
15
20
3
2
26
83
85
117
84
100
117

FIG. 73

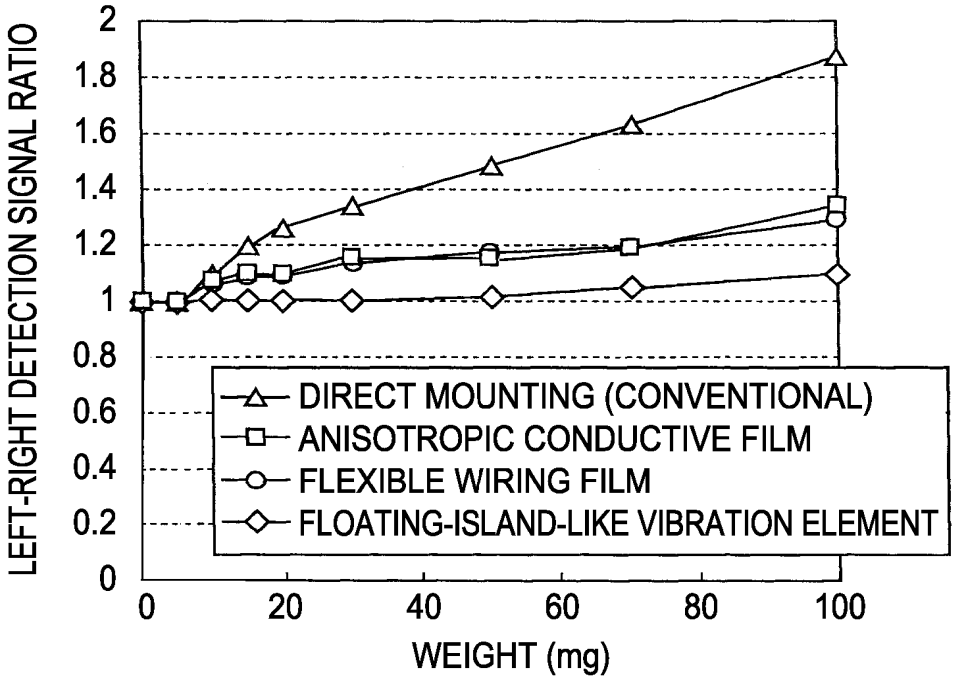
LEFT-RIGHT DETECTION SIGNAL RATIO
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
WEIGHT (mg)
DIRECT MOUNTING (CONVENTIONAL)
ANISOTROPIC CONDUCTIVE FILM
FLEXIBLE WIRING FILM
FLOATING-ISLAND-LIKE VIBRATION ELEMENT

FIG. 74

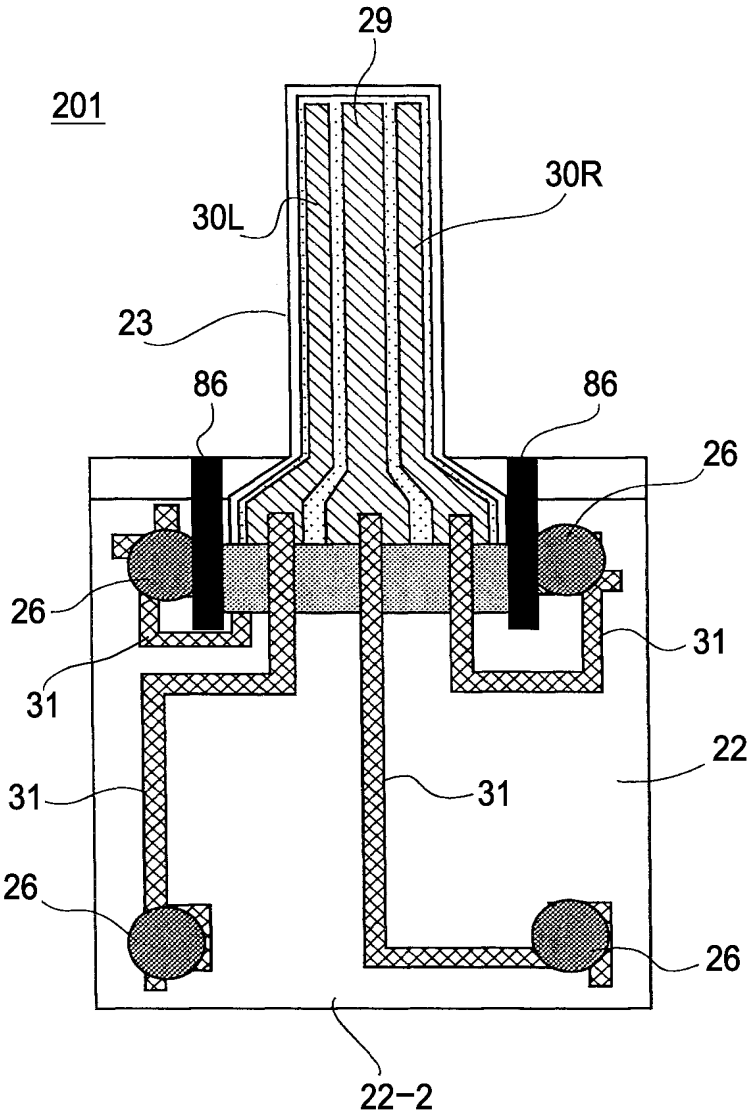

FIG. 75

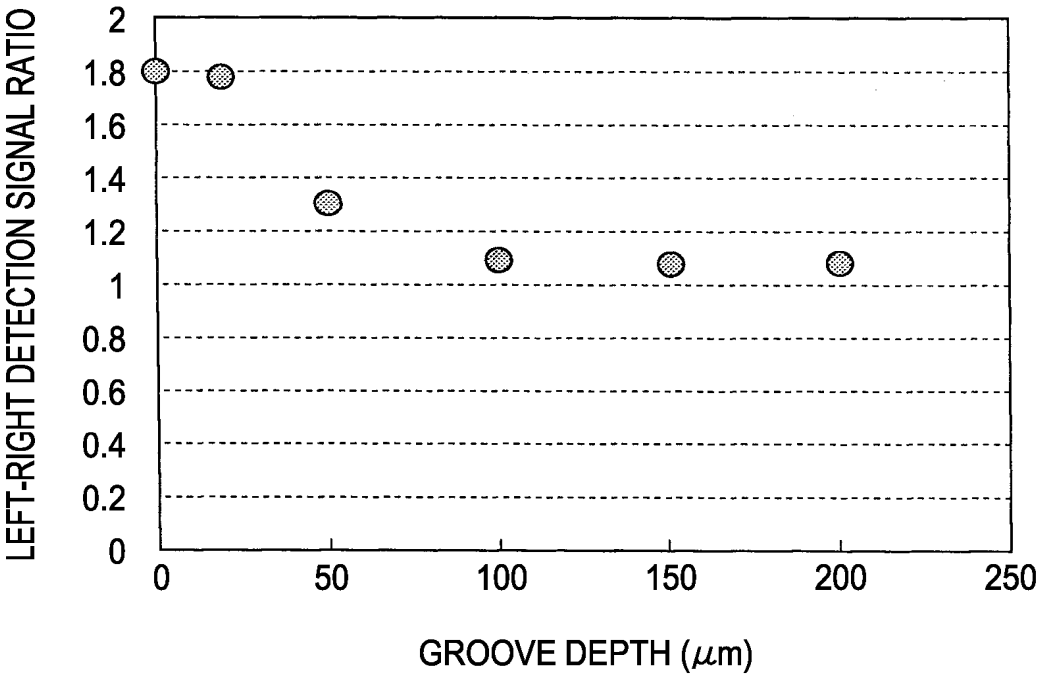
LEFT-RIGHT DETECTION SIGNAL RATIO
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
GROOVE DEPTH (μm)

FIG. 76

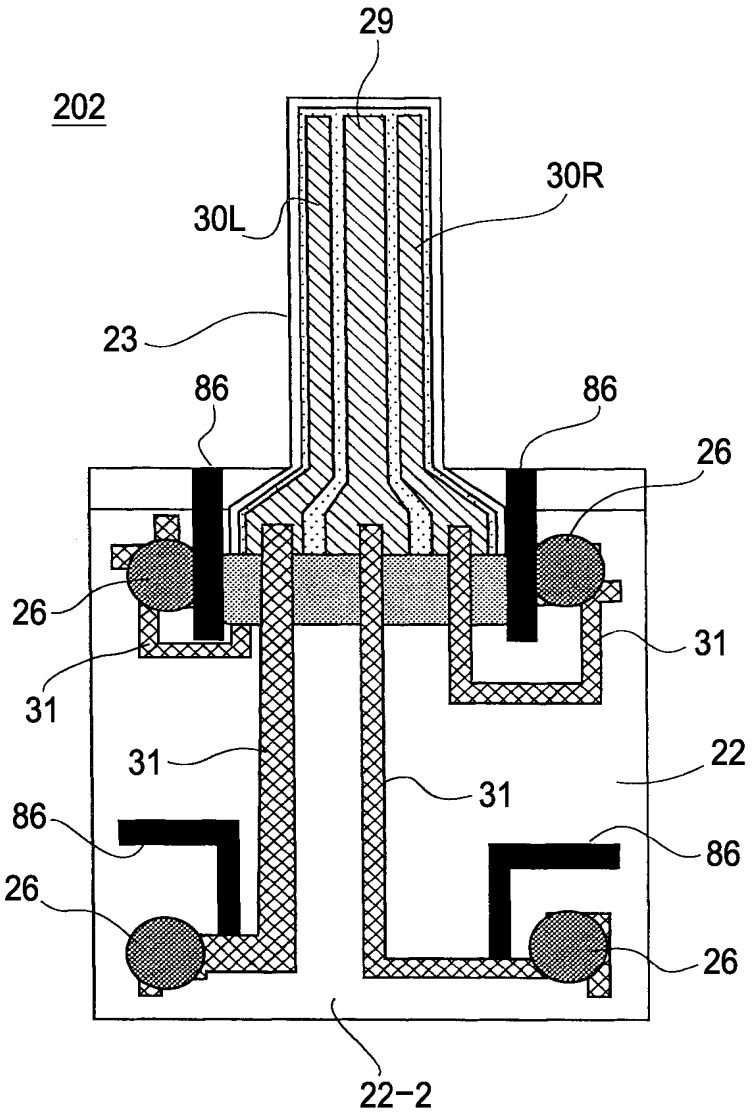

FIG. 77

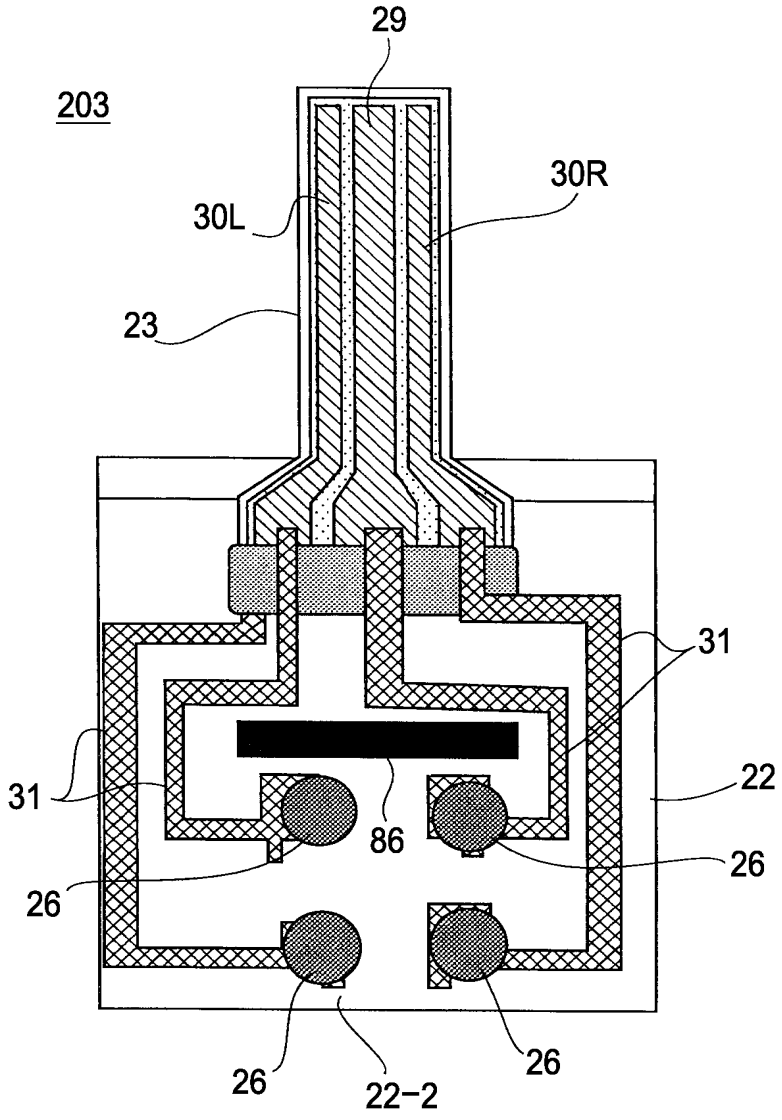

FIG. 78A

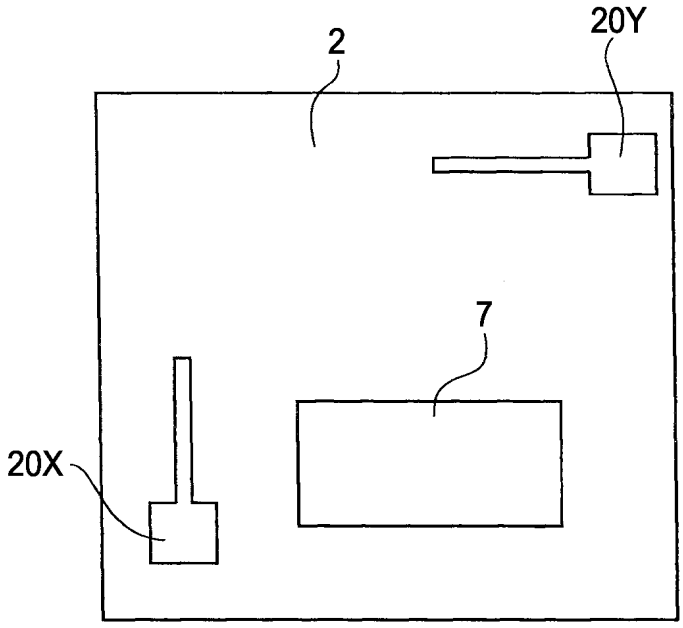

FIG. 78B

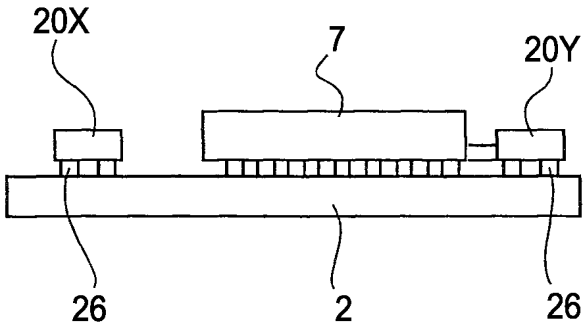

FIG. 79A

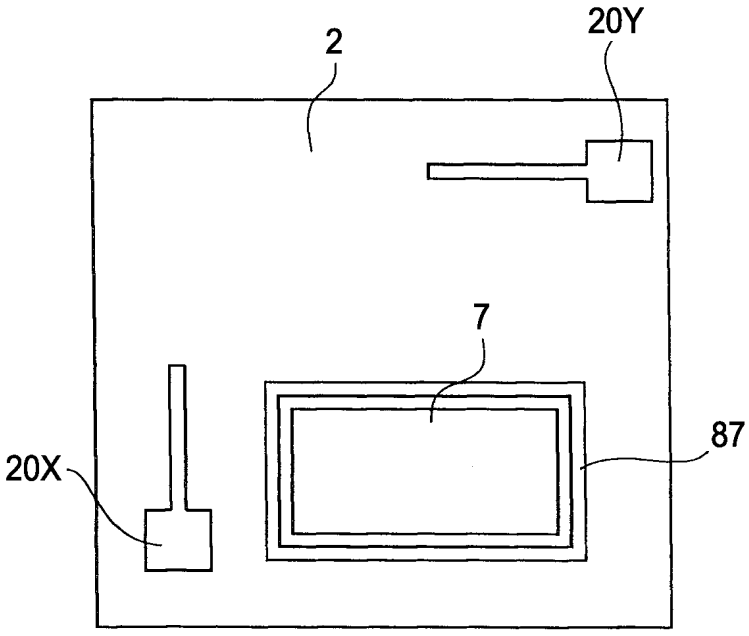

FIG. 79B

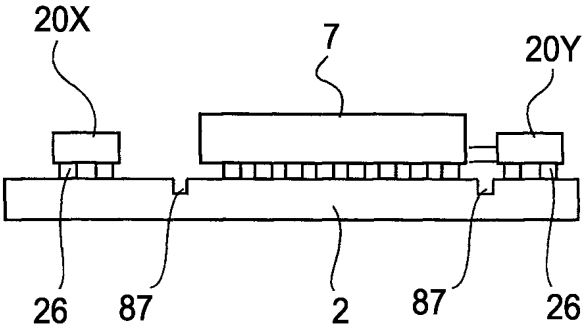

FIG. 80

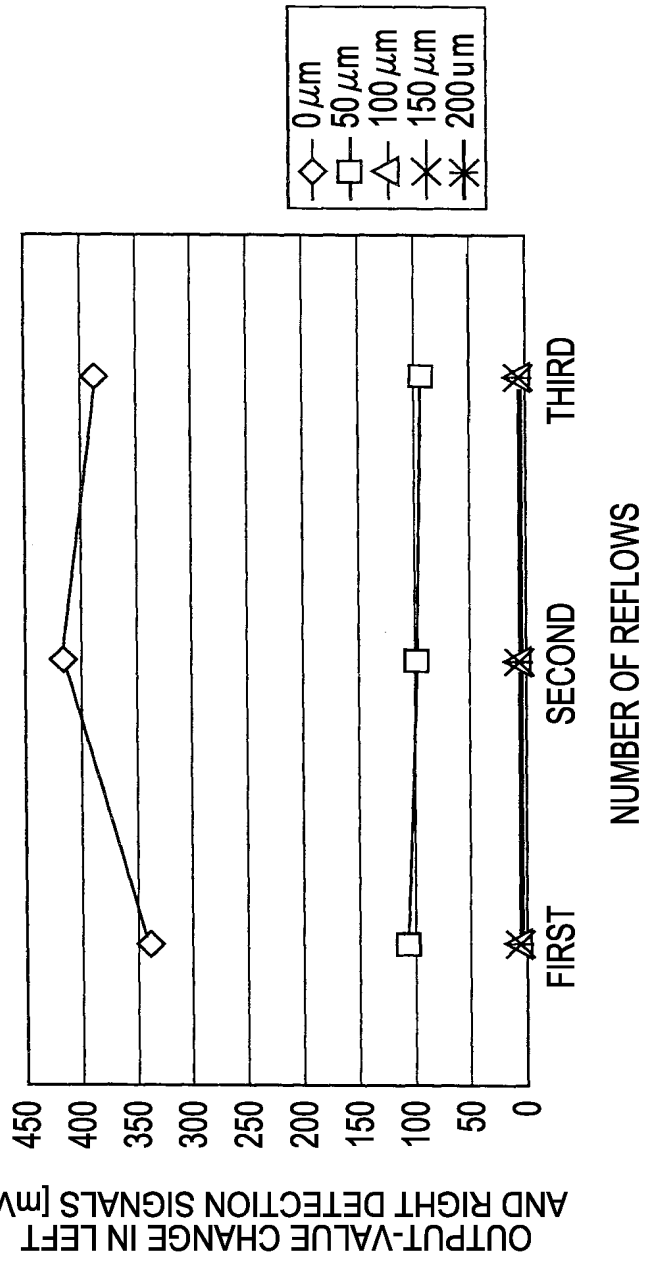
0 μm
50 μm
100 μm
150 μm
200 μm
450
400
350
300
250
200
150
100
50
0
FIRST
SECOND
THIRD
NUMBER OF REFLOWS
OUTPUT-VALUE CHANGE IN LEFT AND RIGHT DETECTION SIGNALS [mV]

FIG. 81

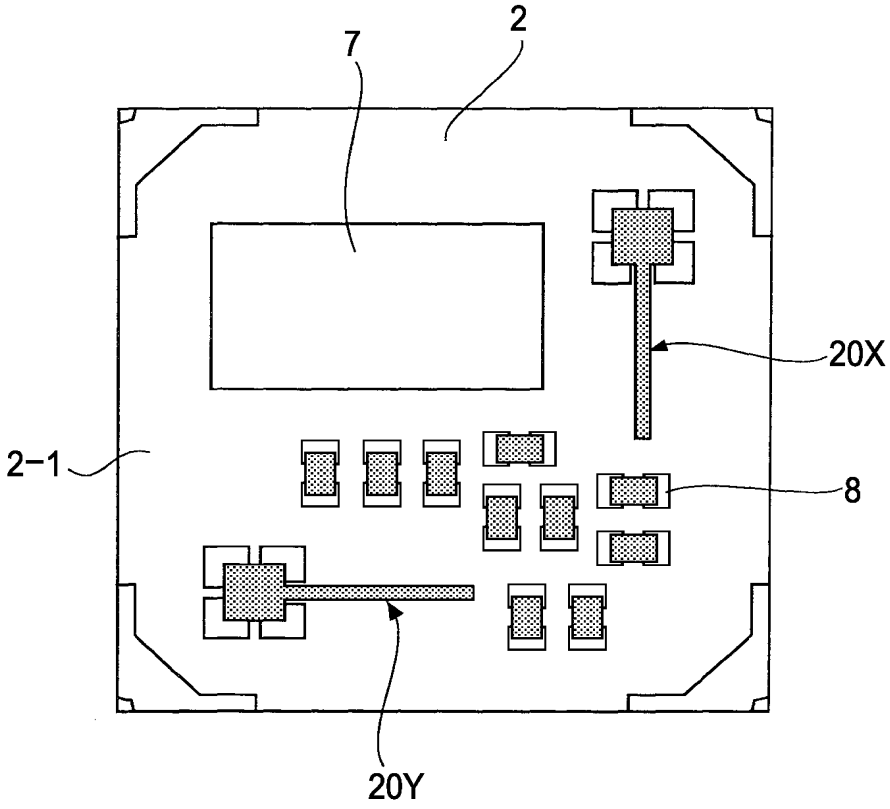

FIG. 82

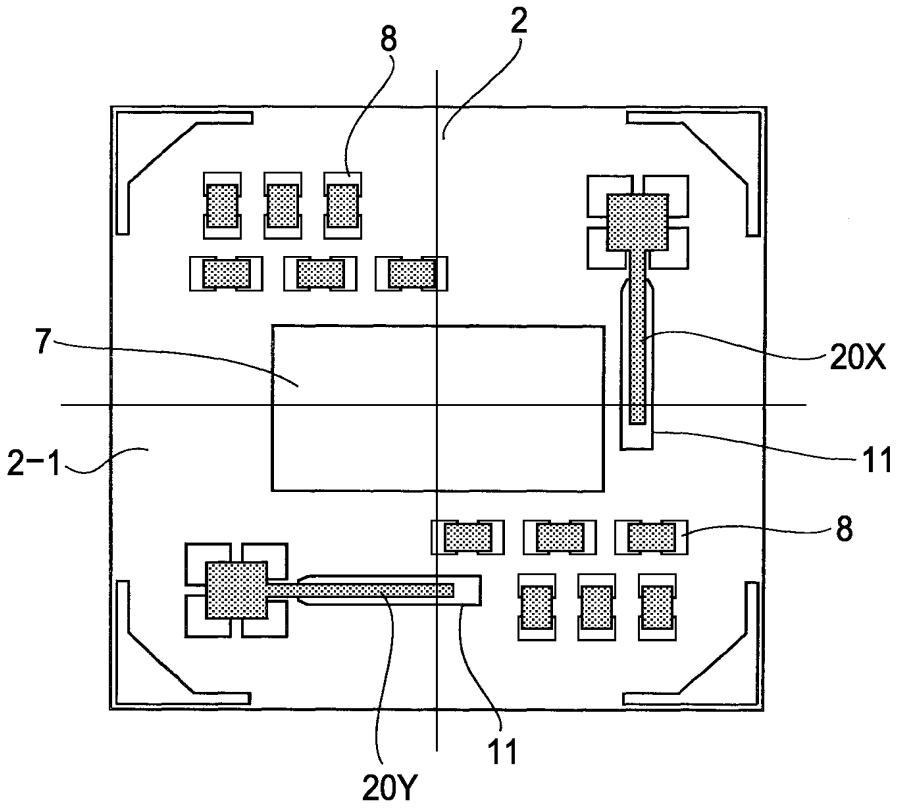

FIG. 83

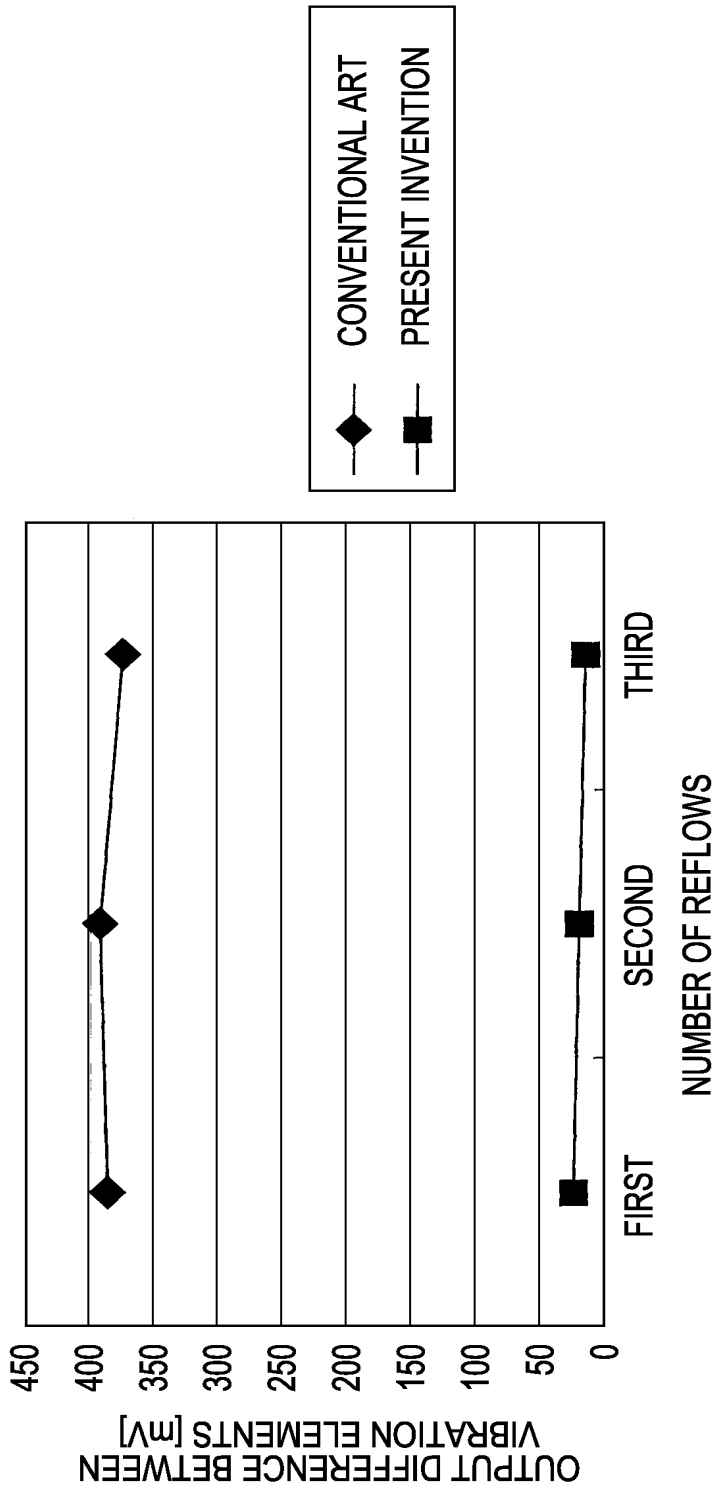
CONVENTIONAL ART
PRESENT INVENTION
OUTPUT DIFFERENCE BETWEEN VIBRATION ELEMENTS [mV]
450
400
350
300
250
200
150
100
50
0
FIRST
SECOND
THIRD
NUMBER OF REFLOWS

FIG. 84A

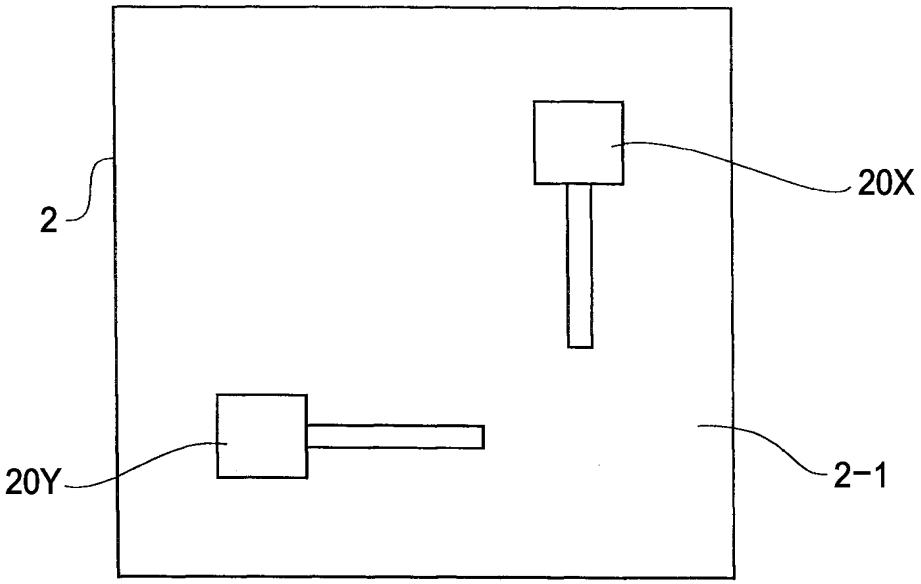

FIG. 84B

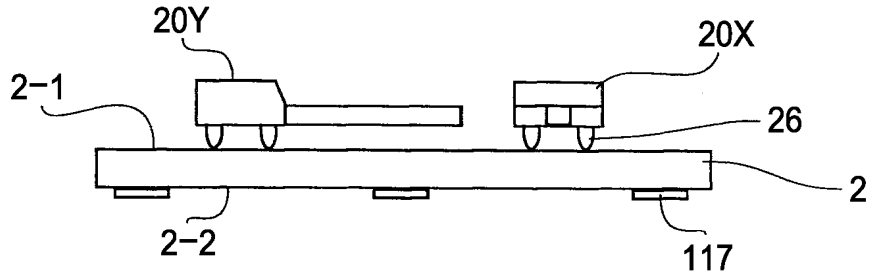

FIG. 84C

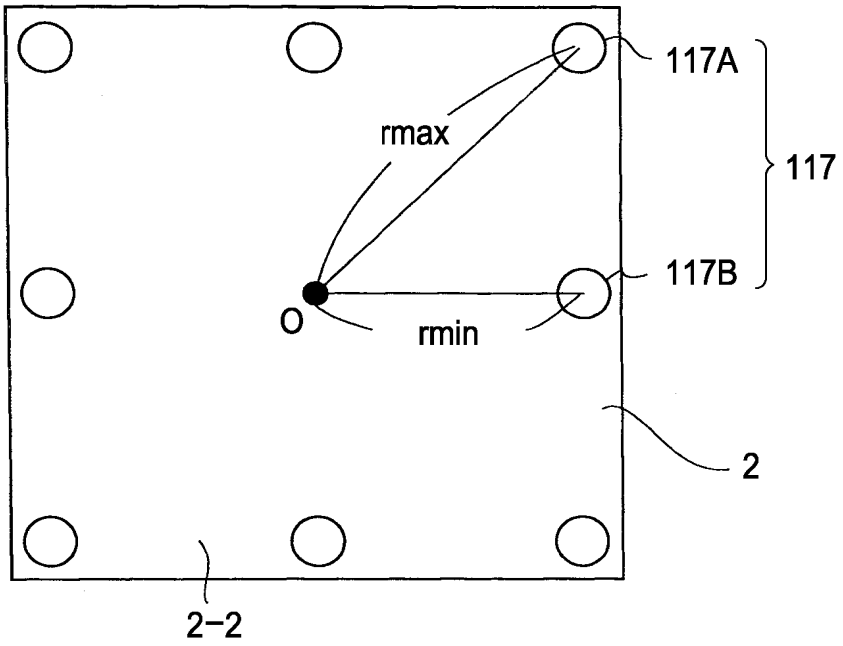

FIG. 85

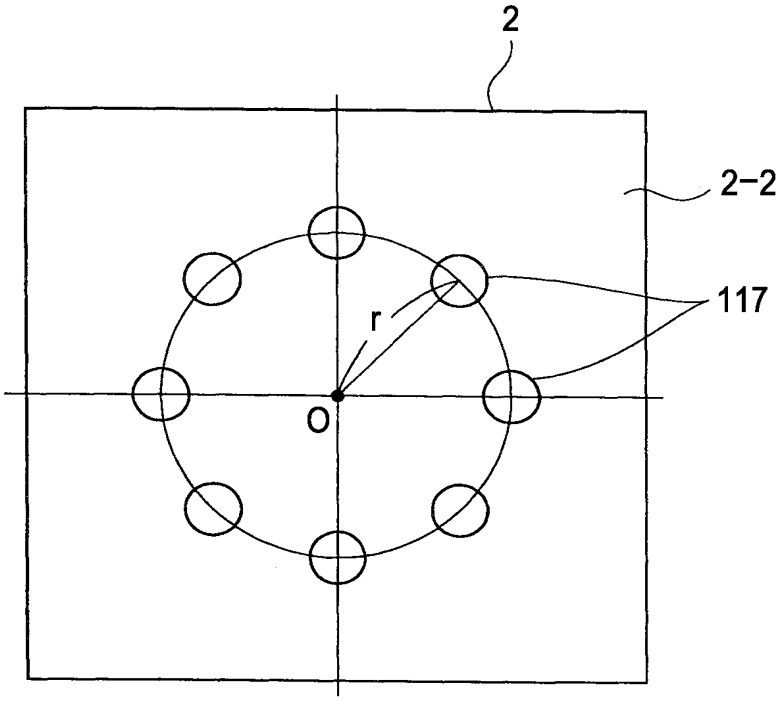

FIG. 86A

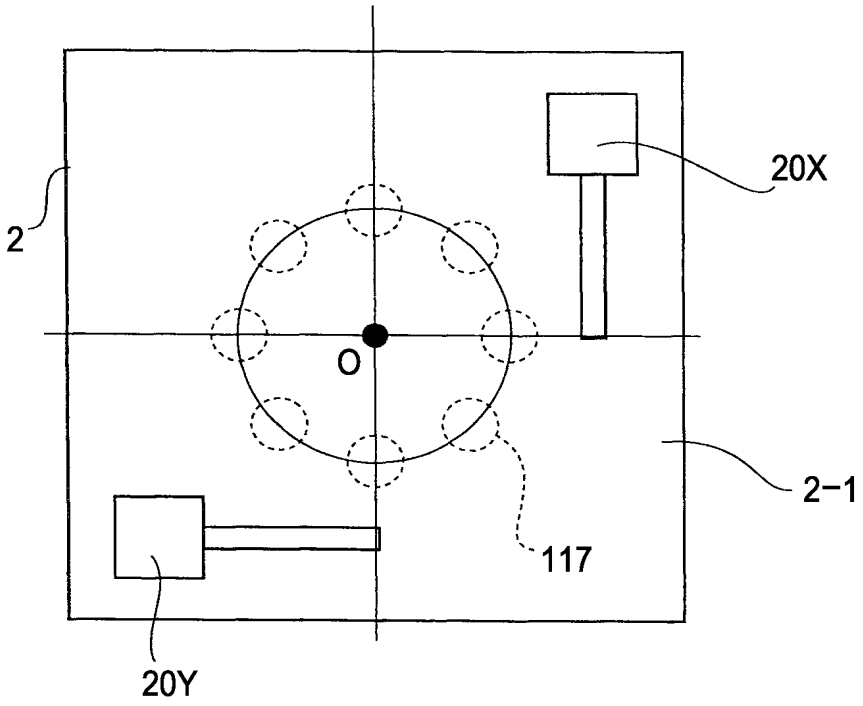

FIG. 86B

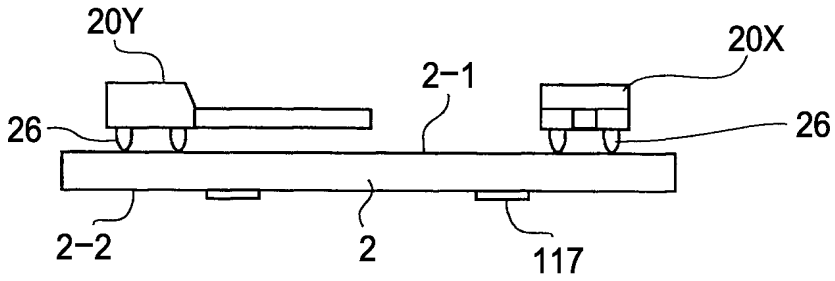

FIG. 87

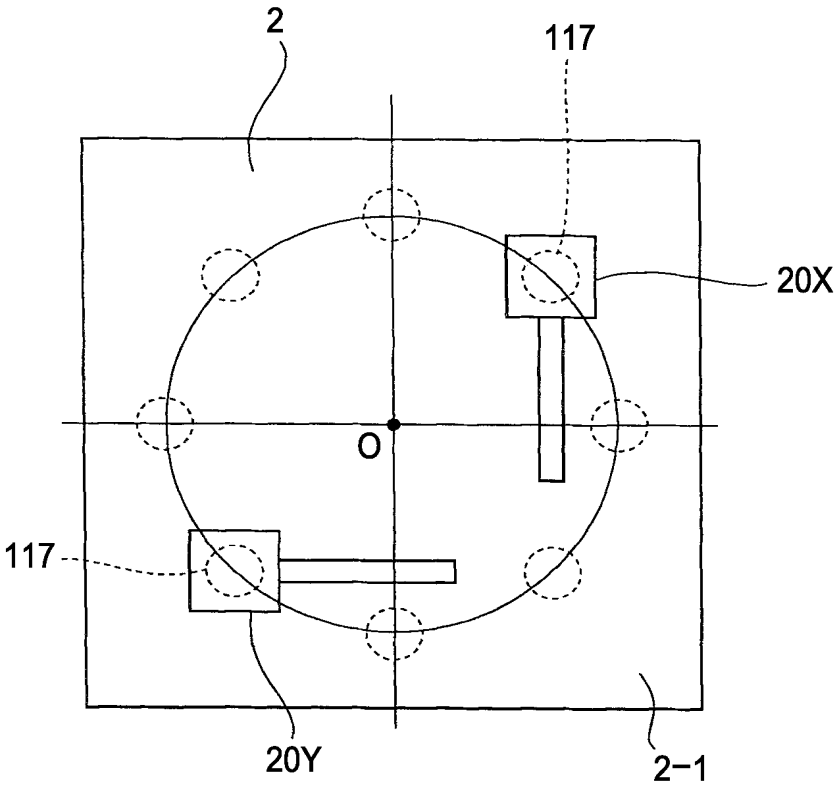

FIG. 88